QUALITY ASSURANCE PROJECT PLAN
PASSAIC SEDIMENTS RM 10.9 INVESTIGATION
Clifton, New Jersey

Prepared for:
United States Environmental Protection Agency/Environmental Response Team
Edison, New Jersey

By:
Lockheed Martin/Scientific, Engineering, Response and Analytical Services
Work Assignment Number: SERAS-222

Based on the Intergovernmental Data Quality Task Force Uniform
Federal Policy for Quality Assurance Project Plans
(Final Version 1.1, June 2006)

January 10, 2014

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Title and Approval Page

Site Name/Project Name: Passaic Sediments RM 10.9 Investigation
Site Location: Clifton, New Jersey (NJ)

Document Title: Passaic Sediments RM 10.9 Investigation QAPP

Lead Organization: Environmental Protection Agency/Environmental Response Team (EPA/ERT)

Preparer's Name and Organizational Affiliation: Deborah A. Killeen, Lockheed Martin/Scientific, Engineering, Response and Analytical Services (SERAS)

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Preparation Date (Day/Month/Year): 01/10/14

Investigative Organization's Project Manager/Date: _____ Signature

Printed Name/Organization: Marc S. Greenberg/ERT Work Assignment Manager

Investigative Organization's Project QA Officer/Date: _____ Signature 1/14/14

Printed Name/Organization: Stephen Blaze/ERT Quality Coordinator

Lead Organization's Project Manager/Date: _____ Signature 1/15/14

Printed Name/Organization: Christopher Gussman/SERAS Task Leader

Approval Signatures/Date: _____ Signature 1/10/14

Printed Name/Title: Deborah Killeen/SERAS QA/QC Officer

Approval Authority: SERAS

Other Approval Signatures/Date _____ Signature 1/12/14

Printed Name/Title: Dennis Miller/SERAS Program Manager

Document Control Numbering System: SERAS-222-DQAPPR1-011014

QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name: Passaic Sediments RM 10.9 Investigation
Site Location: Clifton, New Jersey (NJ)
Site Number/Code:
Operable Unit:
Contractor Name: Lockheed Martin
Contractor Number: EP-W-09-031

Contract Title: SERAS
Work Assignment Number: SERAS-222

1. Identify regulatory program: Comprehensive Environmental Response and Compensation Liability Act (CERCLA)

2. Identify approval entity: EPA/ERT

3. The QAPP is (select one): ☐Generic ☒Project Specific

4. List dates of scoping sessions that were held: 9/4/2013, 9/6/2013, 9/12/2013, 9/23/2013, 10/21/13

5. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Approval Date

6. List organizational partners (stakeholders) and connection with lead organization:
   EPA Region 2

7. List data users:
   EPA Region 2

8. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusions below:

QAPP Worksheet #2
QAPP Identifying Information
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QAPP Worksheet #2
QAPP Identifying Information
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☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #3
Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Marc S. Greenberg	WAM (Primary)	ERT	732-452-6413	732-321-6724	Greenberg.marc@epa.gov	SERAS-222-DQAPPR1-011014
Mark Sprenger	WAM (Secondary)	ERT	732-906-6826	732-321-6724	Sprenger.mark@epa.gov	SERAS-222-DQAPPR1-011014
Tom Kady	WAM (Secondary)	ERT	732-906-6172	732-321-6724	Kady.thomas@epa.gov	SERAS-222-DQAPPR1-011014
Christopher Gussman	Environmental Scientist (Phytoremediation)/Task Leader (TL)	SERAS	732-321-4237	732-494-4021	Christopher.d.gussman@lmco.com	SERAS-222-DQAPPR1-011014
Deborah Killeen	Quality Assurance/Quality Control (QA/QC) Officer	SERAS	732-321-4245	732-494-4021	Deborah.a.killeen@lmco.com	SERAS-222-DQAPPR1-011014
Dennis Miller	Program Manager	SERAS	732-321-4216	732-494-4021	Dennis.a.miller@lmco.com	SERAS-222-DQAPPR1-011014
Stephen Blaze	Quality Coordinator	ERT	732-906-6921	732-321-6724	Blaze.stephen@epa.gov	SERAS-222-DQAPPR1-011014
Eugenia Naranjo	Remedial Project Manager (RPM)	EPA R2	212-637-3467	NA	Naranjo.eugenia@epa.gov	SERAS-222-DQAPPR1-011014

☐ Worksheet Not Applicable (State Reason)

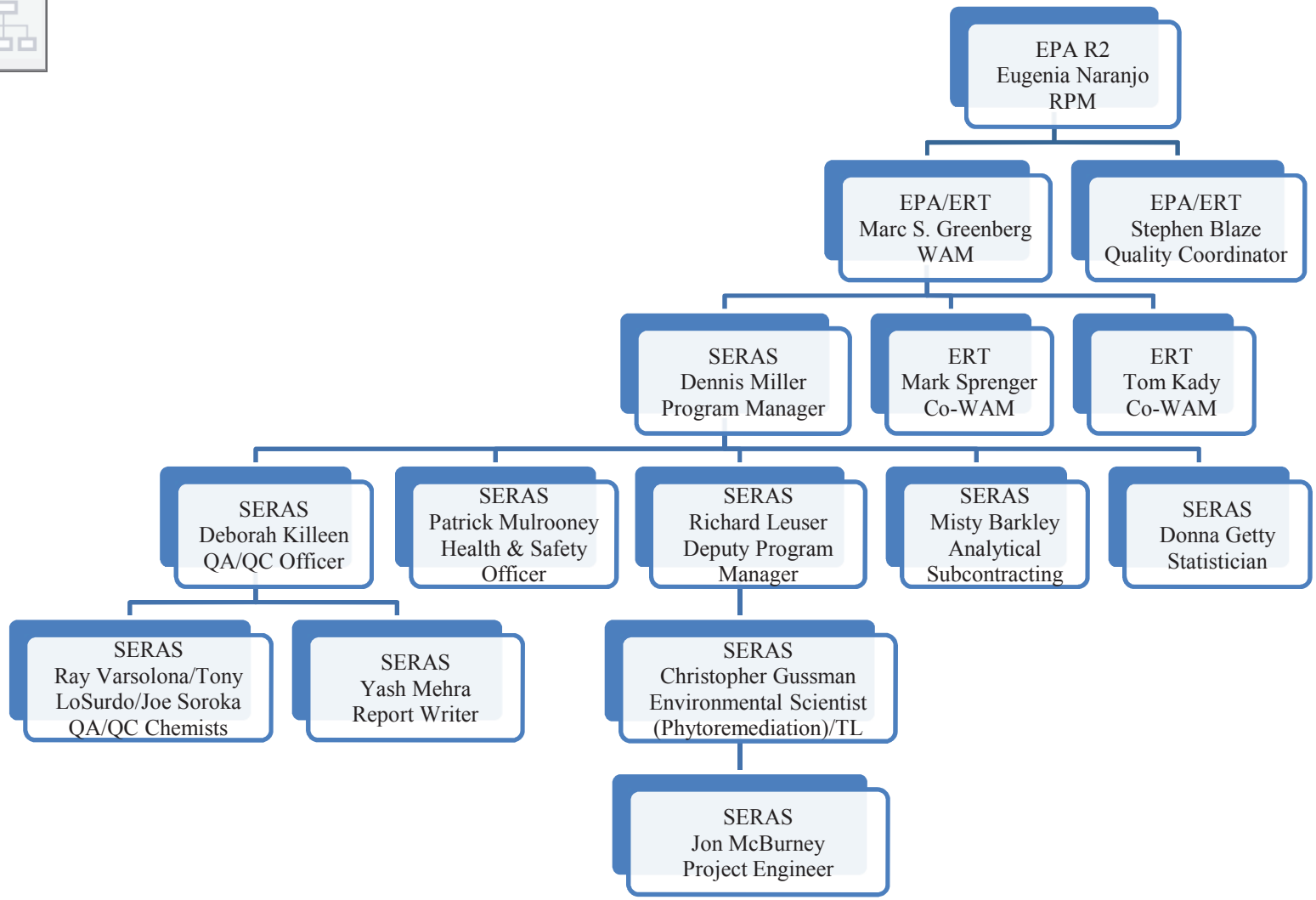
QAPP Worksheet #4
Project Personnel Sign-Off Sheet

Organization: ERT/SERAS

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Marc S. Greenberg	ERT WAM (Primary)	732-452-6413		
Mark Sprenger	ERT WAM (Secondary)	732-906-6826		
Tom Kady	ERT WAM (Secondary)	732-906-6172		
Christopher Gussman	SERAS Environmental Scientist (Phytoremediation)/TL	732-321-4237		
Eugenia Naranjo	EPA R2 RPM	212-637-3467		
Jonathan McBurney	SERAS Project Engineer	732-321-4244		
Jean Bolduc	SERAS Geologist	732-321-4280		

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #5
Project Organizational Chart



☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Approval of initial QAPP and any amendments	ERT WAM ERT Quality Coordinator SERAS Program Manager SERAS QA/QC Officer SERAS TL	Marc S. Greenberg Stephen Blaze Dennis A. Miller Deborah Killeen Christopher Gussman	(732) 452-6413 (732) 906-6921 (732) 321-4216 (732) 321-4245 (732) 321-4237	SERAS internal peer review, followed by ERT approval, implementation of changes effective only with approved QAPP or QAPP Change Form.
Nonconformance and Corrective Action	SERAS TL ERT WAM SERAS QA/QC Officer	Christopher Gussman Marc S. Greenberg Deborah Killeen	(732) 321-4237 (732) 452-6413 (732) 906-6929	Use of the Work Assignment Field Change Form for field issues.
Posting of Deliverables to the ERT-Information Management System (IMS) website	SERAS TL SERAS QA/QC Officer SERAS Deputy Program Manager SERAS Administrative Support	Christopher Gussman Deborah Killeen Richard Leuser Eileen Ciambotti	(732) 321-4237 (732) 321-4245 (732) 494-4060 (732) 321-4255	As per work assignment, posting of deliverables to ERT-IMS website constitutes delivery to the WAM.
Work Assignment	SERAS Program Manager SERAS TL	Dennis A. Miller Christopher Gussman	(732) 321-4216 (732) 321-4237	Describes scope of work to SERAS personnel from the ERT WAM.
Contract/Purchasing Communications	SERAS TL SERAS Analytical Subcontracting	Christopher Gussman Misty Barkley	(732) 321-4237 (732) 321-4205	SERAS TL will communicate with Contract/Purchasing Liason
Health & Safety	SERAS TL	Christopher Gussman	(732) 321-4237	Site Health & Safety Meeting

QAPP Worksheet #7
Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	Task Leader, Project Supervision, Field Sampling, Reporting, Document Preparation/Site Visit	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Jon McBurney	Project Engineer	SERAS	Field Sampling Activities	Minimum B.S. degree plus 14 years of related experience/Lockheed Martin Employee Files
Jean Bolduc	Geologist	SERAS	Field Sampling Activities	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Deborah Killeen	QA/QC Officer	SERAS	Quality Assurance/Validation Oversight and Deliverable Review/QAPP Preparation/Site Visit	Minimum B.S. degree plus 14 years of related experience/Lockheed Martin Employee Files
Ray Varsolona	QA/QC Chemist	SERAS	Data Validation	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Tony LoSurdo	QA/QC Chemist	SERAS	Data Validation	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Yash Mehra	Report Writer	SERAS	Report & EDD Preparation	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Joseph Soroka	QA/QC Chemist	SERAS	Data Validation	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Misty Barkley	Subcontract Laboratory Liaison	SERAS	Subcontract Laboratory Communications	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Donna Getty	Statistician	SERAS	Historical Data Review/Sampling Design	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Marc S. Greenberg	WAM	EPA/ERT	Technical Direction/Oversight	EPA Job-related qualifications/EPA Files
Stephen Blaze	Quality Coordinator	ERT	QA Oversight	EPA job-related qualifications/EPA Files
Eugenia Naranjo	RPM	EPA	Project Oversight	EPA job-related qualifications/EPA Files
Mark Sprenger	Co-WAM	EPA/ERT	Technical Direction/Oversight	EPA Job-related qualifications/EPA Files
Tom Kady	Co-WAM	EPA/ERT	Technical Direction/Oversight	EPA Job-related qualifications/EPA Files

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Project Oversight	Health & Safety Training	SERAS	Nov 2012	Christopher Gussman	Environmental Scientist (Phytoremediation)/TL/ SERAS	SERAS H&S Files
Field Activities	Health & Safety Training	SERAS	Dec 2012	Jonathan McBurney	Project Engineer/SERAS	SERAS H&S Files
Field Activities	Health & Safety Training	SERAS	Sept 2013	Jean Bolduc	Geologist/SERAS	SERAS H&S Files
Site Visit	Health & Safety Training	SERAS	Oct 2012	Deborah Killeen	QA/QC Officer/SERAS	SERAS H&S Files
Validation Support	Annual Data Integrity Training/Peak Integration Training	SERAS	Jun 2012	Raymond Varsolona Tony Losurdo Joe Soroka	QA/QC Chemist/SERAS	SERAS Quality Files
Validation Support	Annual Data Integrity Training/Peak Integration Training	SERAS	Jun 2012	Yash Mehra	Report Writer/SERAS	SERAS Quality Files
QA Oversight	Data Review & Validation	Laboratory Data Consultants	Jan 2007	Deborah Killeen	QA/QC Officer/SERAS	SERAS Quality Files
QA Oversight	Uniform Federal Policy for Quality Assurance Project Plans	Advanced Systems	Jan 2006	Deborah Killeen	QA/QC Officer/SERAS	SERAS Quality Files

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #9-1
Project Scoping Session Participants Sheet

Project Name: Givaudan: Transport Pathway to Passaic River **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Givaudan: Transport Pathway to Passaic River **Site Location:** Clifton, NJ

Date of Session: 09/04/2013
Scoping Session Purpose: Answer questions regarding task and establish sampling/analytical strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Marc S. Greenberg	WAM	ERT	732-453-6413	Greenberg.marc@epa.gov	Project Technical Direction
Dennis Miller	Program Manager	SERAS	732-321-4216	Dennis.a.miller@lmco.com	Contract oversight
Misty Barkley	Property Coordinator	SERAS	732-321-4205	Misty.barkley@lmco.com	Analytical Subcontracting
Richard Leuser	Deputy Program Manager	SERAS	732-494-4060	Richard.m.leuser@lmco.com	Project Review
Deb Killeen	QA/QC Officer	SERAS	732-321-4245	Deborah.a.killeen@lmco.com	QA/Validation Oversight/QAPP Preparation
Donna Getty	Statistician	SERAS	732-321-4274	Donna.j.getty@lmco.com	Statistical/sampling design support
Mark Sprenger	WAM	ERT	732-906-6826	Sprenger.mark@epa.gov	Technical Support
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	Christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination
Tim Kubiak	Supervisory Fish & Wildlife Biologist	USFWS	609-383-3938 x26	Tim_Kubiak@fws.gov	Technical Support

Comments/Decisions: Givaudan manufactured flavors, fragrances, and specialty chemicals such as pharmaceutical intermediates and pesticides, at a facility in Clifton, NJ from approximately 1913 to 1998. Trichlorophenol was used at the Givaudan facility in the production of hexachlorophene (HCP). Dioxin (2,3,7,8-TCDD) is inherently a contaminant of the trichlorophenol feed stock and resultant production process wastes; 1,2,4,5,7,8-hexachloroxanthene (HCX) has also been associated with the production of HCP. Between 1951 and 1969, the Diamond Alkali Company operated a facility at 80 Lister Avenue, in Newark, New Jersey, manufacturing pesticides. Among other chemicals, the company manufactured 2,4,5-trichlorophenoxy acetic acid, a by-product of which is 2,3,7,8-TCDD. Production activities at the Diamond Alkali facility ceased in August 1969.

Sediment samples collected in 2011 in the vicinity of RM 10.9 showed elevated concentrations of 2,3,7,8-TCDD and other contaminants at the surface. The age of the surface dates back to 1960. To evaluate Givaudan's potential as a source of dioxin, and to evaluate and compare with the contribution of dioxin from the Diamond Alkali facility, HCP, HCX and 2,4,6,8-tetrachlorodibenzothiophene (TCDT) are compounds of interest in addition to the 12-dioxin-like congeners, 17 dioxins/furans and total polychlorinated biphenyls (PCBs) as Aroclors.

According to the USFWS, HCP, HCX and 2,3,7,8-TCDT are available from Cambridge Isotope (isotope.com) on pages 165, 181 and 206. USGS and USEPA analytical chemists have expertise with some or all of these compounds. For example, the EPA Region I Narragansett lab has expertise with HCX and TCDT.

The areas of focus for sampling are: 1) River at mudflat both core and surface – surface is defined as the top 6 inches (″); 2) Waste cell on Givaudan Property – 3-5' in depth and 3) Waste cell on Diamond Alkali property – 3-5' in depth. EPA would like to oversample side-by-side cores, if possible.

EPA would like us to get out there before the current USEPA removal action that includes dredging and capping is complete. The project decision statement should reflect the presence/absence of analytes and the ratios of the varoius analytes. Typical QC samples (field duplicates, matrix spikes/matrix spike duplicates [MS/MSDs], etc.) will be inserted into the sample stream.

Action Items: SERAS will continue working with the labs to determine the feasibility of getting HCP, HCX and 2,4,6,8-TCDT analyzed. EPA will set up conference calls with USGS and then with the Narragansett lab to give us some insight into the extraction and analysis procedures.

QAPP Worksheet #9-2
Project Scoping Session Participants Sheet

Project Name: Givaudan: Transport Pathway to Passaic River **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Givaudan: Transport Pathway to Passaic River **Site Location:** Clifton, NJ

Date of Session: 09/06/2013
Scoping Session Purpose: Answer questions on analytical methodologies for TCDT.

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Marc S. Greenberg	WAM	ERT	732-453-6413	Greenberg.marc@epa.gov	Project Technical Direction
Dennis Miller	Program Manager	SERAS	732-321-4216	Dennis.a.miller@lmco.com	Contract Oversight
Misty Barkley	Property Coordinator	SERAS	732-321-4205	Misty.barkley@lmco.com	Analytical Subcontracting
Deb Killeen	QA/QC Officer	SERAS	732-321-4245	Deborah.a.killeen@lmco.com	QA/Validation Oversight/QAPP Preparation
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	Christopher.d.gussman@lmco.com	TL/Project Oversight & Coordination
Tim Kubiak	Supervisory Fish & Wildlife Biologist	USFWS	609-383-3938 x26	Tim_Kubiak@fws.gov	Technical Support
Paul Peterman	Chemist	USGS	573-876-1830	ppeterman@usgs.gov	Technical Support
Kathy Echols	Research Chemist	USGS	573-876-1838	kechols@usgs.gov	Technical Support
Raymond Varsolona	QA/QC Chemist	SERAS	732-494-4054	Raymond.a.varsolona@lmco.com	Validation Support

Comments/Decisions: 2,4,6,8-TCDT is a compound of interest as it has been identified as an indicator of the production process waste of HCP. 2,3,7,8-Tetrachlorodibenzothiophene is available from Cambridge Isotope. Jan Anderson at the University of Muenster has several dibenzothiophenes that would be helpful to determine where the peaks are. TCDT was analyzed using high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS) using a DB-5MS column in the selective ion monitoring (SIM) mode. In the Group 2 window, 95 percent (%) of the tetrachlorothiophenes elute with the penta dioxins/furans. The penta window needs to be stretched to see 2,3,7,8-TCDT otherwise it may be missed. 2,4,6,8-TCDT is one of the early eluters in the window (1/4 to 1/5 of the Group 2 window). An average response factor (RF) of 1 was assigned for the 2,4,6,8-TCDT (Refer to the Tracy et al and the Peterman et al references listed in Worksheet 13)

The standard extraction method for dioxins/furans was used. For the carbon cleanup separation, the lab should collect both fractions to make sure that this compound isn't missed (i.e., retain the eluate that removes the interfering compounds in section 13.5.4 of EPA Method 1613B prior to inverting the column and eluting the TCDDs/TCDFs with toluene)

There are several papers from the proceedings of the dioxin meetings (dioxin20xx.org) that can be referred to. Extraction and analysis of HCX by Karen Tracy, Battelle, Columbus, Ohio in 2003, go to organohalogen compounds 560, pp177-180. For chromatography of TCDT, see Peterman 2006, Enhanced Chemistry of Dibenzothiophenes, Figure 1 or Figure 2. This links HCX from HCP. Table 1 shows a 50% degradation of HCX in 30 days in nonane only. Table 2 shows the calibration curves. HCX survives the 1613 extraction method (hexa to hepta).

HCP is an inexpensive standard that can be obtained from Sigma. Beller 1988 demonstrated a relatively long half-life for this compound. Allard in 1959 indicated that HCP is quite resistant to change. EPA Method 8270 would work better if it was a derivatization method.

Action Items: Misty will relay this information to the laboratories that may potentially perform work.

QAPP Worksheet #9-3
Project Scoping Session Participants Sheet

Project Name: Givaudan: Transport Pathway to Passaic River **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Givaudan: Transport Pathway to Passaic River **Site Location:** Clifton, NJ

Date of Session: 09/06/2013
Scoping Session Purpose: Answer questions on sampling/analytical strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Misty Barkley	Property Coordinator	SERAS	732-321-4205	Misty.barkley@lmco.com	Analytical Subcontracting
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	Christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination
Raymond Varsolona	QA/QC Chemist	SERAS	732-494-4054	Raymond.a.varsolona@lmco.com	Validation Support
Martha Maier	Laboratory Director	Vista	916-673-1520	mmaier@vista-analytical.com	Analytical Support
Andrew Patterson	Technical Director	Vista	916-673-1520	apatterson@vista-analytical.com	Analytical Support

Comments/Decisions: Updates: Ultra Scientific is trying to synthesize 2,4,6,8-TCDT. Cambridge Isotope would synthesize the compound along with a labeled compound in approximately 4 to 6 weeks.

The lab stated that they seem to have better recovery for HCX and TCDT if they modify the EPA Method 1613 extraction. HCX and 2,4,6,8-TCDT would be analyzed together by high resolution mass spectrometry separate from the dioxins. HCP would be analyzed by liquid chromatography/mass spectrometry (LC/MS).

Ray recommended a labeled 2,4,6,8-TCDT due to possible co-elution with 1,2,8,9-TCDD. This would also give a final concentration based on the recovery of the labeled standard.

UPDATE (11/13/13): A labeled and unlabeled source of 2,4,6,8-TCDT will be purchased from Cambridge Isotopes.

QAPP Worksheet #9-4
Project Scoping Session Participants Sheet

Project Name: Givaudan: Transport Pathway to Passaic River **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Givaudan: Transport Pathway to Passaic River **Site Location:** Clifton, NJ

Date of Session: 09/12/2013
Scoping Session Purpose: Answer questions on sampling/analytical strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Marc S. Greenberg	WAM	ERT	732-453-6413	Greenberg.marc@epa.gov	Project Technical Direction
Misty Barkley	Property Coordinator	SERAS	732-321-4205	Misty.barkley@lmco.com	Analytical Subcontracting
Deb Killeen	QA/QC Officer	SERAS	732-321-4245	Deborah.a.killeen@lmco.com	QA/Validation Oversight/QAPP Preparation
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	Christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination
Tim Kubiak	Supervisory Fish & Wildlife Biologist	USFWS	609-383-3938 x26	Tim_Kubiak@fws.gov	Technical Support
Richard Pruell	Chemist	EPA R1	401-782-3091	Pruell.richard@epa.gov	Technical Support
Bryan Taplin	Chemist	EPA R1	401-782-9607	Taplin.bryan@epa.gov	Technical Support
Raymond Varsolona	QA/QC Chemist	SERAS	732-494-4054	Raymond.a.varsolona@lmco.com	Validation Support
Eugenia Naranjo	RPM	EPA R2	212-637-3467	Naranjo.eugenia@epa.gov	Project Oversight

Comments/Decisions: EPA started off the meeting stating that this investigation will be forensic to determine if other potentially responsible parties (PRPs) may have contributed to part of the contamination.

EPA R1 personnel stated that they didn't necessarily look for HCX but found it in the dioxin analysis. 2,4,6,8-TCDT can be found in the same fraction as dioxins. HCX is a by-product that is more dominant in the HCP process than 2,3,7,8-TCDD. EPA R1 stated that the use of Dionex solid phase extraction (SPE) may be better than Soxhlet extraction.

QAPP Worksheet #9-5
Project Scoping Session Participants Sheet

Project Name: Givaudan: Transport Pathway to Passaic River **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Givaudan: Transport Pathway to Passaic River **Site Location:** Clifton, NJ

Date of Session: 09/23/2013
Scoping Session Purpose: Answer questions on sampling/analytical strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Marc S. Greenberg	WAM	ERT	732-453-6413	Greenberg.marc@epa.gov	Project Technical Direction
Misty Barkley	Property Coordinator	SERAS	732-321-4205	Misty.barkley@lmco.com	Analytical Subcontracting
Deb Killeen	QA/QC Officer	SERAS	732-321-4245	Deborah.a.killeen@lmco.com	QA/Validation Oversight/QAPP Preparation
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	Christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination

Comments/Decisions: Marc stated that we will go ahead with the HCP and the HCX analyses and not the TCDT. Unlabeled and labeled HCP and unlabeled HCX will be used for analysis (what is available). We are looking at 0-2 foot and 2-4 foot intervals for analysis.

Dredging will be completed by October 2, 2013. Stephanie Vaughn (RPM for removal action) will be sending a dredging map. There may be some areas that we will be able to sample.

EPA needs a cost estimate today from SERAS that includes everything (method development, calibration, analysis and method detection limit costs) so he can provide this estimate to the Region.

Action Items: SERAS will supply costs to EPA this afternoon by 3pm (Completed).

UPDATE: Field activities will occur as soon as possible. Two cores will be taken from the dredge zone, 2 cores from cut 5 or 6 (after dredging) and 2 cores from the zone outside of the removal area boundary. Approximately 12 to 15 samples will be collected along with one field duplicate.

UPDATE: Since a source of the labeled and unlabeled 2,4,6,8-TCDT standard is now available, analysis of TCDT will be pursued.

QAPP Worksheet #9-6
Project Scoping Session Participants Sheet

Project Name: Givaudan: Transport Pathway to Passaic River **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Givaudan: Transport Pathway to Passaic River **Site Location:** Clifton, NJ

Date of Session: 10/21/13
Scoping Session Purpose: Answer questions on sampling/analytical strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Marc S. Greenberg	WAM	ERT	732-453-6413	Greenberg.marc@epa.gov	Project Technical Direction
Misty Barkley	Property Coordinator	SERAS	732-321-4205	Misty.barkley@lmco.com	Analytical Subcontracting
Deb Killeen	QA/QC Officer	SERAS	732-321-4245	Deborah.a.killeen@lmco.com	QA/Validation Oversight/QAPP Preparation
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	Christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination
Donna Getty	Statistician	SERAS	732-321-4274	Donna.j.getty@lmco.com	Sampling Design

Comments/Decisions: Capping operations began on 10/28/13. The initial sampling design was scoped as follows: Would like 6 cores in the Passaic River up to 16 samples and one field duplicate. Cesium-137 and beryllium-7 analyses need to be conducted to see recent and historic sediment depositions. Sediment (one core) from each of the areas (no-dredge, downstream of the Removal Area and at the Third River) needs to be dated. Sampling in the river is tentatively due to occur the week of 11/11/13. Six samples will be collected from each of the waste cells located on the Givaudan and Diamond Alkali properties during a subsequent mobilization.

Action Items: SERAS needs to look at the historical data and see where the highest concentrations of contaminants have been found and propose sampling locations and revisions to the initial sampling design.

UPDATE: Field Activities will occur the week of 11/18/13. Add an additional location at the Dundee Dam, upstream of the Third River. There will be a total of 13 locations (4 in the non-dredge zone, 3 in the downstream of Removal Area zone, 2 at the Passaic and Third Rivers confluence, 3 in the Third River and one upstream reference location).

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #10
Problem Definition

The problem to be addressed by the project: A limited and focused study will be conducted by the Environmental Response Team (ERT) at the request of the EPA Region 2 Emergency and Remedial Response Division (ERRD) to evaluate potential sources of contamination found in the sediment deposit at river mile (RM) 10.9 of the Passaic River including both the former Givaudan facility and the former Diamond Alkali facility. This study will provide data that will be used by EPA Region 2 to inform future site management decisions. The Lower Passaic River (LPR) is an operable unit of the Diamond Alkali Superfund Site. The LPR 17-mile Remedial Investigation/Feasibility Study (RI/FS) is being conducted by a group of approximately 70 potentially responsible parties (PRPs) called the Cooperating Parties Group (CPG) under an Administrative Order of Consent (AOC) that was signed in May 2007. The RI/FS is scheduled to be complete in 2015. The LPR is tidal and flows from the Dundee Dam at RM 17.4 through densely populated and industrialized areas into Newark Bay. Beginning in the early nineteenth century, the LPR watershed was a major center for industrialized operations including cotton mills, manufactured gas plants, paper manufacturing and chemical manufacturing facilities. These facilities discharged dioxins, petroleum hydrocarbons, PCBs, pesticides and metals to the LPR. Dioxins continue to be a risk driver at the site. CPG has agreed to perform the actions necessary to remove, treat and/or properly dispose of approximately 20,000 cubic yards (yd^3) of sediment from the designated RM 10.9 Removal Area and cap this area, to address elevated concentrations of PCDDs/PCDFs, PCBs, metals and PAHs detected in the sediment at RM 10.9. The former Givaudan facility is situated on approximately 31 acres in a mixed industrial/residential area near RM 10.9 of the western river bank of the LPR in Clifton, NJ. The Passaic River is located approximately 0.3 miles to the southeast of the facility and is tidally influenced. Givaudan manufactured flavors, fragrances and specialty chemicals and operated at this location from 1913 to 1998. Trichlorophenol was used in the manufacture of HCP. Dioxin is inherently a contaminant of the trichlorophenol feed stock and may be present in resultant production process wastes. HCX has also been associated with the production of HCP. Givaudan ceased operation of the facility in 1998 and currently, the property is occupied by three warehouse buildings in active use that are operated by the Morris Companies.
The environmental questions being asked: Are compounds that may be potentially linked to the Givaudan facility or Diamond Alkali facility present or absent from the sediments at RM 10.9? Are the ratios and/or chemical chromatographic signatures of contaminants found in the river sediments similar to those ratios found in samples collected from the Givaudan and/or Diamond Alkali waste cells? How similar or dissimilar are the contaminant ratios and/or chemical chromatographic signatures between the Givaudan and the Diamond Alkali waste cells?
Observations from any site reconnaissance reports: NA
A synopsis of secondary data or information from site reports: Technical papers regarding analytical methods for the compounds of interest will be used as references for method enhancement. Diagrams, figures, inter-office memos, etc. will aid in the development of the conceptual site model to determine potential contaminant transport pathways to the Passaic River.
The possible classes of contaminants and the affected matrices: PCDDs/PCDFs, pesticides, total PCBs, PCB congeners, HCP, HCX and tetrachlorinated dibenzothiophenes (TCDT) in sediment and waste

The rationale for inclusion of chemical and nonchemical analyses: PCDDs/PCDFs – Dioxins continue to be a risk driver for the site. These compounds are associated with Givaudan's and/or Diamond Alkali's former operations and elevated concentrations in this area were previously documented. Diamond Alkali is also a known source of PCDDs/PCDFs. Total PCB and PCB congeners – Elevated concentrations in this area were previously documented. HCP – This compound was previously produced at the Givaudan facility from trichlorophenol HCX – This compound has been associated with the production of HCP TCDT – The ratio of 2,4,6,8 – tetrachlorodibenzothiophene to 2,3,7,8-tetrachlorodibenzodioxin is expected to be useful for environmental forensics. Cesium-137 and Beryllium-7 – Used for dating the age of the sediments.
Information concerning various environmental indicators: The RM 10.9 Removal Action will include dredging of the sediment to a predetermined depth (uppermost two feet). An engineering cap will be constructed, monitored and maintained. A small portion along the shore at the northeastern most end of the Removal Area cannot be capped due to the grade of the existing slope; thus, this small portion will be dredged to remove contaminated sediment to native material. The Jersey City Municipal Authority has established a no-dredge zone in the vicinity of two potable water supply lines that transect the RM 10.9 Removal Area.
Project decision conditions ("If..., then..." statements): If PCDDs/PCDFs, total PCBs, PCB congeners, HCP and HCX are detected in river sediments, then ERT will evaluate the potential linkage of these contaminants to the sources under investigation (i.e., former Givaudan and Diamond Alkali facilities) in light of the historical data and conceptual site model of the contaminant transport pathways. EPA Region 2 will then use the evaluation to inform future site management decisions. If the ratios or multi-variate analysis of various contaminants of concern indicate a pattern and linkages to the sources under investigation, then EPA Region 2 will use the evaluation to inform future site management decisions.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #11
Project Quality Objectives /Systematic Planning Process Statements

Who will use the data? ERT, EPA Region 2, ERRD and the Office of Regional Counsel (ORC)
What will the data be used for? Data will be used to evaluate potential sources of contamination at RM 10.9 and may increase EPA's understanding of the LPR.
What type of data is needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques) PCDD/PCDFs + TCDT by EPA Method 1613, off-site laboratory PCB Congeners and total PCBs by EPA Method 1668C, off-site laboratory HCX and HCP by laboratory-developed methods, off-site laboratory Cesium-137 (Cs-137) and Beryllium-7 (Be-7) by gamma spectrometry, off-site laboratory GPS data of each sample location, field data
How "good" do the data need to be in order to support the environmental decision? PCDD/PCDF, PCB congener, total PCBs, HCX, HCP, TCDT, Cs-137 and Be-7 will be considered Definitive Data. GPS data will be considered supporting meta data and Screening Data (verified but not validated).
How much data are needed? (number of samples for each analytical group, matrix, and concentration) From the River: PCDD/PCDFs, PCB Congeners, HCX, HCP, TCDT – 19 sediment samples, Cs-137 and Be-7 – 50 sediment samples and GPS – 13 sediment locations. From the Waste Cells: PCDD/PCDFs, PCB Congeners, HCX, HCP, TCDT – 12 samples
Where, when, and how should the data be collected/generated? Sediment samples will be collected the week of November 18, 2013 using vibracore techniques. The river has been broken down into three areas of interest: the "no-dredge" zone within a portion of the Removal Area; the area below the designated Removal Area; and the confluence of the Passaic and Third Rivers and within the Third River. Sediment samples will be collected from the locations identified on Figure 1, Proposed Sampling Map. An additional sample will be collected near the area known as the Dundee Dam, upstream of the confluence of the Third and Passaic Rivers as a reference. Specific information on depths and analyses can be found on Worksheet #14. At a later date (to be determined), approximately 6 samples will be collected from each of the waste cells located on the Givaudan and Diamond Alkali properties The QAPP will be amended to reflect this work.
Who will collect and generate the data? A vibracore contractor will be procured to advance sediment core samples to approximate depths below the sediment surface depending on design targets (see Worksheets 14, 17 and 18) and collect GPS data on those cores. Sediment cores will be recovered and transferred to SERAS personnel for processing after they are collected, cut and capped. GPS data on locations where vibracoring is not an option (i.e., depositional sediment surface sampling in the Third River) will be recorded by SERAS field personnel. Sediment samples after processing will be submitted to Vista Analytical and Outreach laboratories for analysis.

How will the data be reported? Validated data for the sediment samples will be reported in a Final Analytical Report (AR) that will be prepared in accordance with SERAS SOP #4020, *Analytical Report Preparation.* A Trip Report (TR) will be prepared and delivered to the EPA/ERT WAM in accordance with SERAS SOP #4017, *Preparation of Trip Reports* after the field mobilization. A draft summary report will be prepared that will include a weight of evidence discussion with accompanying tables and spreadsheets that summarize the data. This report will be prepared in accordance with SERAS SOP #4019, *Preparation of Preliminary Reports*. Data will be disseminated to EPA Region 2 by the WAM.
How will the data be archived? Hard copies of all deliverables will be stored in SERAS Central Files and e-copies will be stored on SERAS Local Area Network (LAN). Data will be imported into a Scribe database and posted to the ERT IMS website. Data will be archived by SERAS in accordance with Administrative Procedure (AP) #34, *Archiving Data Electronic Files.* Analytical data from the outside laboratory will be archived by the SERAS QA/QC Group both in hard copy and electronically.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #12-1
Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group	PCDD/PCDF/TCDT*
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria		QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or Both (S&A)
SERAS SOP #2016	EPA Method 1613	Accuracy/Bias (Contamination)	<RL		Method Blank	A
		Accuracy/Bias	2378-TCDD	6.7-15.8 ng/mL	Ongoing Precision & Accuracy (OPR)	A
			2378-TCDF	7.5-15.8 ng/mL		
			12378-PeCDD	35-71 ng/mL		
			12378-PeCDF	40-67 ng/mL		
			23478-PeCDF	34-80 ng/mL		
			123478-HxCDD	35-82 ng/mL		
			123678-HxCDD	38-67 ng/mL		
			123789-HxCDD	32-81 ng/mL		
			123478-HxCDF	36-67 ng/mL		
			123678-HxCDF	42-65 ng/mL		
			123789-HxCDF	39-65 ng/mL		
			234678-HxCDF	35-78 ng/mL		
			1234678-HpCDD	35-70 ng/mL		
			1234678-HpCDF	41-61 ng/mL		
			1234789-HpCDF	39-69 ng/mL		
			OCDD	78-144 ng/mL		
			OCDF	63-170 ng/mL		
			$^{13}C_{12}$-2378-TCDD	20-175 ng/mL		
			$^{13}C_{12}$-2378-TCDF	22-152 ng/mL		
			$^{13}C_{12}$-12378-PeCDD	21-227 ng/mL		
			$^{13}C_{12}$-12378-PeCDF	21-192 ng/mL		
			$^{13}C_{12}$-23478-PeCDF	13-328 ng/mL		
			$^{13}C_{12}$-123478-HxCDD	21-193 ng/mL		

Matrix	Sediment
Analytical Group	PCDD/PCDF/TCDT*
Concentration Level	Low

			$^{13}C_{12}$-123678- HxCDD	25-163 ng/mL		
			$^{13}C_{12}$-123789 HxCDD	21-193 ng/mL		
			$^{13}C_{12}$-123478-HxCDF	19-202 ng/mL		
			$^{13}C_{12}$-123678-HxCDF	21-159 ng/mL		
			$^{13}C_{12}$-123789-HxCDF	17-205 ng/mL		
			$^{13}C_{12}$-234678-HxCDF	22-176 ng/mL		
			$^{13}C_{12}$-1234678-HpCDD	26-166 ng/mL		
			$^{13}C_{12}$-1234678-HpCDF	21-158 ng/mL		
			$^{13}C_{12}$-1234789-HpCDF	20-186 ng/mL		
			$^{13}C_{12}$-OCDD	26-397 ng/mL		
			$^{13}C_{12}$-OCDF	26-397 ng/mL		
			$^{37}Cl_4$-2378-TCDD	3.1-19.1 ng/mL		
		Accuracy/Bias	$^{13}C_{12}$-2378-TCDD	25-164 ng/mL	Labeled Compounds (Samples)	A
			$^{13}C_{12}$-2378-TCDF	24-169 ng/mL		
			$^{13}C_{12}$-12378-PeCDD	25-181 ng/mL		
			$^{13}C_{12}$-12378-PeCDF	24-185 ng/mL		
			$^{13}C_{12}$-23478-PeCDF	21-178 ng/mL		
			$^{13}C_{12}$-123478-HxCDD	32-141 ng/mL		
			$^{13}C_{12}$-123678- HxCDD	28-130 ng/mL		
			$^{13}C_{12}$-123789 HxCDD	32-141 ng/mL		
			$^{13}C_{12}$-123478-HxCDF	26-152 ng/mL		
			$^{13}C_{12}$-123678-HxCDF	26-123 ng/mL		
			$^{13}C_{12}$-123789-HxCDF	29-147 ng/mL		
			$^{13}C_{12}$-234678-HxCDF	28-136 ng/mL		
			$^{13}C_{12}$-1234678-HpCDD	23-140 ng/mL		
			$^{13}C_{12}$-1234678-HpCDF	28-143 ng/mL		
			$^{13}C_{12}$-1234789-HpCDF	26-138 ng/mL		
			$^{13}C_{12}$-OCDD	17-157 ng/mL		
			$^{13}C_{12}$-OCDF	17-157 ng/mL		
			$^{37}Cl_4$-2378-TCDD	35-197 ng/mL		
		Precision	RPD ±35%		Field Duplicate	S & A
		Accuracy/Bias	%R = 50-150 (for native compounds only)		Matrix Spike (MS)	S & A

Matrix	Sediment
Analytical Group	PCDD/PCDF/TCDT*
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or Both (S&A)
		Precision	RPD ±20%	MS/Matrix Spike Duplicate (MSD)	S & A
		Completeness	>90% sample collection, >90% completed analyses	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (see Section 3.2)
*TCDT will be added on to the PCDD/PCDF analysis if a TCDT standard is available

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #12-2
Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group[1]	PCB Congeners
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[9]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2016	EPA Method 1668C	Accuracy/Bias (Contamination)	<RL	Method Blank	A
		Accuracy/Bias	%R = 60-135	OPR*	A
		Accuracy/Bias	^{13}C-Mono, Di, TriCB + ^{13}C-23'4'5-TetraCB (%R = 5-145) Remaining Tetra, Penta, Hexa, Hepta , Octa, Nona and DecaCBs (%R = 10-145)	Internal Standards	A
		Accuracy/Bias	%R = 10-145	Cleanup Recovery Standards	A
		Accuracy/Bias	%R = 50-150%	MS*	S & A
		Precision	RPD ±20%	MS/MSD*	S & A
		Precision	RPD ±35%	Field Duplicate	S & A
		Completeness	>90% sample collection, >90% completed analyses	Data Completeness Check	S & A

*Spiked with PCB-5/PCB-8, PCB-18, PCB-20/21/33, PCB-28, PCB-31, PCB-43/49, PCB-44, PCB-52/69, PCB-56/60, PCB-61/70, PCB-74, PCB-76/66, PCB-87/117/125, PCB-90/101, PCB-95/98/102, PCB-97, PCB-99, PCB-105, PCB-118/106, PCB-110, PCB-128/162, PCB-132/161, PCB-138/163/164, PCB-139/149, PCB-146/165, PCB-151, PCB-153, PCB-156, PCB-158/160, PCB-170, PCB-174, PCB-177, PCB-180, PCB-182/187, PCB-183, PCB-194, PCB-195, PCB-196/203, PCB-201.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #12-3
Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group	Low
Concentration Level	HCX

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2016	Vista SOP #41	Accuracy/Bias (Contamination)	<RL	Method Blank	A
		Accuracy/Bias	%R = 50-150	OPR	A
		Accuracy/Bias	%R = 25-150	^{13}C-123789-HxCDF (Internal Standard)	A
		Accuracy/Bias	%R = 25-150	^{13}C-123789HxCDD (Cleanup Recovery Standard)	A
		Accuracy/Bias	%R = 50-150	MS	S & A
		Precision	RPD ±20%	MS/MSD*	S & A
		Precision	RPD ±35%	Field Duplicate	S & A
		Completeness	>90% sample collection, >90% completed analyses	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (see Section 3.2)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #12-4
Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group	HCP
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2016	Vista SOP #50	Accuracy/Bias (Contamination)	<RL	Method Blank	A
		Accuracy/Bias	%R = 50-120%	OPR	A
		Accuracy/Bias	%R = 5-153	^{13}C-Hexachlorophene (Internal Standard)	A
		Accuracy/Bias	%R = 50-150	MS	S & A
		Precision	RPD ±50%	MS/MSD	S & A
		Precision	RPD ±35%	Field Duplicate	S & A
		Completeness	>90% sample collection, >90% completed analyses	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (see Section 3.2)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #12-5
Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group	Radiochemistry for Be-7 and Cs-137
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2016	Outreach SOP #RAD_04-11	Precision	<20 RPD	Laboratory Duplicates	A
		Precision	RPD ±35%	Field Duplicates	S & A
		Accuracy	%R = 80-120% or acceptance range set by vendor	LCS	A
		Completeness	>90% sample collection, >90% completed analyses	Data Completeness Check	S & A

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Historical River Mile 10.9 Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, Dioxin/Furan Data for RM 10.9, August 2008 to May 2012	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Historical River Mile 10.9 Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, PCB Congener Data for RM 10.9, August 2011 to May 2012	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Historical River Mile 10.9 Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, Total PCB Data for RM 10.9, August 2008 to February 2012	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Historical River Mile 10.9 Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, WHO-PCB Data for RM 10.9, August 2008 to May 2012	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Historical River Mile 11 to 11.5 Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, Dioxin/Furan Data for RM 10.9, December 1991 to June 2012	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Historical Third River Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, Dioxin/Furan Data for RM 10.9, February 1990 to August 2008	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Final Design Report for Removal Action	CPG, Newark, NJ River Mile 10.9 Removal Action Final Design Report, Lower Passaic River Study Area, May 6, 2013	CH2MHill, TCDD, total PCB, mercury data	Removal area summary of chemical parameters and identification of utilities within the no-dredge zone	No coordinates are given for the no-dredge zone

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Diagram	Givaudan, Plant Sewer System Diagram	Sewer system diagram	Used to develop conceptual site model	
Diagram	Givaudan, October 12, 1983	Site Storm Drainage Sewer System Diagram	Used to develop conceptual site model	
Diagram	Givaudan, October 12, 1983	Site Stormwater Drainage Diagram	Used to develop conceptual site model	
Diagram	Givaudan, April 5, 1991	Contaminated TCDD Non-Process Areas	Used to develop conceptual site model	
Closure Activities	Givaudan-Roure Lagoon Closure Plan, NJPDES Permit No. NJ088374, May 1, 1996	Crest Engineering Associates, Inc., Hightstown, NJ, On-site storm sewer system changes	Used to develop conceptual site model	
Bypassed Waste	Affidavit of Seymour A. Letkin, January 6, 1994	State of Florida, County of Palm Beach	Used to develop conceptual site model	
Map	Clifton Storm Sewers	Undated	Used to develop conceptual site model	
Inter-Office Memo	Givaudan, Interoffice Memo, December 22, 1995	Stormwater Management Master Plan	Used to develop conceptual site model	
Map	Givaudan, Delineated TCDD Remediated Areas and Sample Locations	Environmental Resources Management (ERM), Inc.	Used to develop conceptual site model	
Map	ERM, Figure 1-3, Abandoned Waste Site Location Map, Givaudan Corporation	NA	Used to develop conceptual site model	
Memo	NJDEP, July 14, 1981	Site Inspection Report, Site Tour	Used to develop conceptual site model	
Diagram	Killam Associates	Passaic Valley Sewerage Commission, Overflow Chamber, Yantacaw Street, Clifton	Used to develop conceptual site model	
Letter	Givaudan, April 18, 1984	USEPA, OSWER, Request for information on HCP process	Used to develop conceptual site model	

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Final Draft Report	USEPA, Waste Streams from Hexachlorophene Manufacturing Processes	Radian Corporation, RTP, NC, production processes	Used to develop conceptual site model	
Letter	Givaudan, April 30, 1984,	Radian Corp	Used to develop conceptual site model	
Letter	Givaudan, June 19, 1984	Radian Corp on behalf of USEPA	Used to develop conceptual site model	
Excerpt	Givaudan, A Current Overview of the Occurrence, Toxicity and Disposal of 2,3,7,8-TCDD, no date	TCDD pathways	Used to develop conceptual site model	
Memo	Tierra Solutions, Recovery of G11 in Sewer Ditch and Pond, 1951	Givaudan, HCP product recovery	Used to develop conceptual site model	
Letter to NJDEP	Givaudan –Roure Infiltration/Percolation Lagoon Industrial Contingency Requirements/Proposed Emergency Repair Plan	Discussion of overflow conditions	Used to develop conceptual site model	
Report	Tierra Solutions, Inc., Hexachloroxanthene Method Development Report, May 2012	Environmental Data Services, Inc., validation of previous samples analyzed for HCX	Historical analytical data, analytical method and validation guidelines	
Technical Paper	Archer & Crone, Hexachloroxanthene Analysis with TCDD, Organohalogen Compounds Vol. 45 (2000)	USEPA Region 7, HCX analysis	Historical background on HCX analysis	
Technical Paper	Beliveau & al, Discovery of Dioxin Contamination in the Woonasquatucket River, Organohalogen Compounds, Volumes 60-65 (2003)	New England Regional Laboratory, HCX in the TCDD analysis	Historical background on HCX analysis	

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Technical Paper	Gothe & Wachtmeister, Synthesis of 124578-Hexachloroxanthene, Acta Chem. Scand. 26, No. 6 (1972)	Wallenberg Laboratory, University of Stockholm, HCX from HCP	Historical background on HCX from HCP	
Technical Paper	J. Czerwinski, Pathways of Polychlorinated Dibenzothiophenes (PCDTs) in the Environment, Archives of Environmental Protection, Vol. 34, No. 3 (2008), pp. 169-181	Laboratory of Environmental Analyses, Faculty of Environmental Engineering, Lublin University of Technology, Lublin, Poland, PCDT sources and pathways in the environment	Historical background and analytical data	
Technical Paper	Pruell et al, Accumulation of Polychlorinated Organic Contaminants from Sediment by Three Benthic Marine Species, Archives of Environmental Contamination and Toxicology, 24 (1993), pp.290-297	USEPA Environmental Research Laboratory, Narragansett, RI, analytical method for 2,4,6,8-TCDT	Analytical data for TCDT	
Technical Paper	S. Sinkkonen, PCDTs in the environment, Chemosphere, Vol 34, No 12,(1997), pp.2585-2594	Department of Chemistry, University of Jyvaskyla, Jyvaskyla, Finland, analytical methods for PCDTs	Historical background and methodology for PCDTs	
Technical Paper	Huntley et al, Potential Sources of Polychlorinated Dibenzothiophenes in the Passaic River, New Jersey, Chemosphere, Vol 29, No. 2 (1994), pp.257-272	ChemRisk, MBT Environmental Laboratory and Alta Analytical Laboratory, PCDT sources and formation	Background information on PCDT generation	

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Technical Paper	Miltsov et al., Synthesis and Characterization of Polychlorinated Dibenzothiophenes, Organohalogen Compounds, Vol. 19 (1994), pp. 133-135	St Petersburg University, Department of Chemistry, synthesis of PCDTs	Background information on PCDT generation	
Technical Paper	Tracy et al., Extraction and Analysis of Hexachloroxanthene using Modified US EPA Method 1613, Revision B Procedures, Organohalogen Compounds, Vol. 60. (2003), pp. 177-180	Battelle Memorial Institute, Columbus, OH, HCX analytical methodology	Extraction and analysis of HCX	
Figure & Analytical Report as an Appendix	Givaudan Boring Locations Dioxin Containment Cell, 2010 & PCDD/F Laboratory Report	Entrix, Dioxin/furan results for Givaudan waste cell	Background information	
Technical Paper	Peterman et al, Enhanced GC/HRMS Chromatographic Analysis of PBDEs, PCDTs and Other Complex Mixtures with Narrow Bore Thin Film Columns, Organohalogen Compounds, Vol. 68 (2006), pp. 1170-1173	USGS, Columbia Environmental Research Center, Columbia, MO	TCDT Analytical Information	

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #14
Summary of Project Tasks

Sampling Tasks:
Sediment core samples will generally be obtained from surface to depths of 4 to 8 feet below the sediment surface using vibracore techniques (may be more than one core at some locations). Sediment core samples will be collected in four-inch diameter chemically clean rigid sleeves. During core recovery, the subcontractor must minimize sediment loss from the bottom of the core. When the cores are recovered, they will be capped on both ends and kept vertical to minimize disturbance of surficial layers until overlying water can be siphoned off. Locations will be recorded using GPS by the vibracoring subcontractor. The top of the core above the sediment surface will be removed and capped so that the core can be efficiently transported with minimal disturbance. The subcontractor along with SERAS personnel will inspect each core to ensure an intact and representative sample. Intact cores will then be transferred to LM personnel for processing. Samples will be collected in accordance with SERAS SOP #2016, *Sediment Sampling*.

The investigation area has been broken down into three areas of interest: the "no-dredge" zone within a portion of the Removal Area; the area below the designated Removal Area; and the confluence of the Passaic and Third Rivers and within the Third River.
"No-Dredge" Zone - Four cores will be advanced in the "no-dredge" zone to approximately 5 feet. Two samples will be collected from the 0-0.5' and 1-3' intervals and two samples from the 0-0.5' and 3-5' intervals for a total of 8 samples for PCDDs/PCDFs, 209 PCB congeners, total PCBs, HCX, HCP and TCDT. One additional core will be advanced at one of these locations to 5 feet and sampled at each 0.5' interval for Cs-137 and Be-7 for a total of 10 samples.
River Confluence - Two cores will be advanced at the confluence of the rivers to the bottom of the sediment bed. Samples will be collected from the 0-0.5' interval and one foot from the bottom of the sediment. Three additional sediment samples within the Third River on the other side of the Route 21 bridge will be collected at surface only (0-0.5') for a total of 7 samples for PCDDs/PCDFs, 209 PCB congeners, total PCBs, HCX, HCP and TCDT. One additional core will be advanced at one of the two locations at the confluence of the rivers and sampled at each 0.5' interval for Cs-137 and Be-7 for a total of 8-16 samples (depending on the depth).
Downstream of the Removal Area – Three cores will be advanced in this zone to approximately 8 feet. Sediment samples will be collected from the 6-8' interval for PCDDs/PCDFs, 209 PCB congeners, total PCBs, HCX, HCP and TCDT for a total of 3 samples. One additional core will be advanced in this area up to 8 feet with samples collected every 0.5 foot intervals for Cs-137 and Be-7 for a total of 16 samples.
Upstream Reference Location – One sediment sample will be collected from a location above Dundee Dam. It is anticipated that samples will be collected from the 0-0.5' and 1-2' intervals. One additional core will be advanced in this area up to 8 feet with samples collected every 0.5 foot intervals for Cs-137 and Be-7 for a total of 16 samples.

NOTE: Sampling depths are based upon previous information and may not be attainable at some locations.

All non-dedicated sampling equipment will be decontaminated between each sample location as follows:
1. Physical removal of sediment/debris using potable water and a scrub brush or high pressure washer.
2. Non-phosphate detergent wash (liquinox)
3. Water rinse
4. Air dry

At a later date, up to six samples will be collected from each of the waste cells located on the Givaudan and Diamond Alkali properties.

Analysis Tasks: Dioxins/Furans & TCDT by EPA Method 1613B PCB Congeners and total PCBs by EPA Method 1668C HCX – Vista SOP #41, Revision 2 (Gas Chromatography with high-resolution mass spectrometry [GC/HRMS]) HCP – Vista SOP #50, Revision 2 (Liquid Chromatography with quadrapole mass spectrometry [LC/MS/MS]) Cs-137 and Be-7 – Outreach SOP #RAD_04-11 (Gamma Spectroscopy)
Quality Control Tasks: Refer to Worksheet #20 for field QC Samples and Worksheets #12 and #28 for analytical QC Samples based on subcontract laboratory SOPs.
Secondary Data: Historical dioxin and PCB data will be mapped to determine the core locations and sample depths. Refer to Figure 1.
Data Management Tasks: Field data will be recorded in field notebooks. Laboratory data will be recorded in laboratory notebooks. SCRIBE will be used for data management. A Trip Report and a Technical Memorandum (Summary Report) will be posted to the ERT/Information Management System (IMS) website for this WA. Posting of the reports will be considered as completion of the deliverable. Hard copies of the deliverables will be archived in the SERAS Central Files. Electronic formats for the deliverables will be saved on the SERAS archive drive and archived in accordance with AP #34, *Archiving Electronic Files*.
Documentation and Records: Observations noted during field efforts will be documented in accordance with SERAS SOP #4001, *Logbook Documentation* and SERAS SOP #2002, *Sample Documentation*. Documents and records that will be generated during this project include: Work Plan (WP), QAPP, Health and safety plan (HASP), Field Documentation, Laboratory Logbooks, Sample Labels, Chain of Custody Records, Custody Seals, Analytical Report, Data Review Records, Data Reduction Records and Field Change Forms, if necessary. The trip report will include site background, observations and activities, and conclusions, results and/or recommendations. The trip report will be prepared in accordance with SERAS SOP #4017, *Preparation of Trip Reports*. The technical memorandum (summary report) will include brief text and risk summary tables.
Assessment/Audit Tasks: A performance audit of field operations is not anticipated for this project. The tasks associated with the QAPP are assessed using peer and management system reviews. Peer review enables the task leader to identify and correct reporting errors before reports are submitted. Management system reviews establish compliance with prevailing management structure, policies and procedures, and ensures that the required data are obtained.
Data Review Tasks: Analytical data for dioxins/furans, PCB congeners and total PCBs, HCX, HCP and TCDT will be validated in accordance with the SOPs listed in Worksheet #36. All SERAS project deliverables will receive an internal peer review prior to release as per the guidelines established in SERAS Administrative Procedure (AP) #22, *Peer Review of SERAS Deliverables*.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #15-1
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: Dioxins/Furans

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1613B		Achievable Laboratory Limits	
				MDLs	Method QLs[1] (ng/kg)	MDLs (ng/kg)[2]	QLs[3] (ng/kg)
2378 - TCDD	1746-01-6	NS	0.50	NA	1.0	0.0510	0.50
12378 - PeCDD	40321-76-4	NS	1.0	NA	5.0	0.155	1.0
123678-HxCDD	57653-85-7	NS	1.0	NA	5.0	0.211	1.0
123478-HxCDD	39227-28-6	NS	1.0	NA	5.0	0.269	1.0
123789-HxCDD	19408-74-3	NS	1.0	NA	5.0	0.215	1.0
1234678 - HpCDD	35822-46-9	NS	1.0	NA	5.0	0.284	1.0
OCDD	3268-87-9	NS	2.0	NA	10.0	0.446	2.0
2378-TCDF	51207-31-9	NS	0.50	NA	1.0	0.0830	0.50
12378-PeCDF	57117-41-6	NS	1.0	NA	5.0	0.203	1.0
23478-PeCDF	57117-31-4	NS	1.0	NA	5.0	0.0905	1.0
123678-HxCDF	57117-44-9	NS	1.0	NA	5.0	0.0983	1.0
123789-HxCDF	72918-21-9	NS	1.0	NA	5.0	0.122	1.0
123478-HxCDF	70648-26-9	NS	1.0	NA	5.0	0.219	1.0
234678-HxCDF	60851-34-5	NS	1.0	NA	5.0	0.139	1.0
1234678-HpCDF	67562-39-4	NS	1.0	NA	5.0	0.164	1.0
1234789-HpCDF	55673-89-7	NS	1.0	NA	5.0	0.184	1.0
OCDF	39001-02-0	NS	2.0	NA	10.0	0.240	2.0
Total TCDD	NA	NS	1.0	NA	NA	NA	1.0
Total PeCDD	NA	NS	1.0	NA	NA	NA	1.0
Total HeCDD	NA	NS	1.0	NA	NA	NA	1.0
Total HpCDD	NA	NS	1.0	NA	NA	NA	1.0
Total TCDF	NA	NS	1.0	NA	NA	NA	1.0
Total PeCDF	NA	NS	1.0	NA	NA	NA	1.0
Total HxCDF	NA	NS	1.0	NA	NA	NA	1.0

QAPP Worksheet #15-1
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: Dioxins/Furans

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1613B		Achievable Laboratory Limits	
				MDLs	Method QLs[1] (ng/kg)	MDLs (ng/kg)[2]	QLs[3] (ng/kg)
Total HpCDF	NA	NS	1.0	NA	NA	NA	1.0

[1]Based on 10 grams (g) of sample and final volume of 20 microliters (µL)
[2]Based on LOD/LOQ Study from Vista Analytical dated 8/13/2013
[3]Final QL will be adjusted based on the total solids content for each sample.
NS = not specified, NA = not applicable
ng/kg = nanograms per kilogram

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2-MoCB (1)	2051-60-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.644	2.5
3-MoCB (2)	2051-61-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.821	2.5
4-MoCB (3)	2051-62-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.12	2.5
2,2'-DiCB (4)	13029-08-8	NS	10.0	Refer to Table 2	Refer to Table 2	2.61[3]	10.0
2,3-DiCB (5)	16605-91-7	NS	10.0	Refer to Table 2	Refer to Table 2	2.64[4]	10.0
2,3'-DiCB (6)	25569-80-6	NS	5.0	Refer to Table 2	Refer to Table 2	2.16	5.0
2,4-DiCB (7)	33284-50-3	NS	10.0	Refer to Table 2	Refer to Table 2	2.11[5]	10.0
2,4'-DiCB (8)	34883-43-7	NS	10.0	Refer to Table 2	Refer to Table 2	2.64[4]	10.0
2,5-DiCB (9)	34883-39-1	NS	10.0	Refer to Table 2	Refer to Table 2	2.11[5]	10.0
2,6-DiCB (10)	33146-45-1	NS	10.0	Refer to Table 2	Refer to Table 2	2.61[3]	10.0
3,3'-DiCB (11)	2050-67-1	NS	5.0	Refer to Table 2	Refer to Table 2	2.82	5.0
3,4-DiCB (12)	2974-92-7	NS	10.0	Refer to Table 2	Refer to Table 2	4.92[6]	10.0
3,4'-DiCB (13)	2974-90-5	NS	10.0	Refer to Table 2	Refer to Table 2	4.92[6]	10.0
3,5-DiCB (14)	34883-41-5	NS	5.0	Refer to Table 2	Refer to Table 2	1.30	5.0
4,4'-DiCB (15)	2050-68-2	NS	5.0	Refer to Table 2	Refer to Table 2	2.87	5.0
2,2,3'-TrCB (16)	38444-78-9	NS	5.0	Refer to Table 2	Refer to Table 2	1.30[7]	5.0
2,2',4-TrCB (17)	37680-66-3	NS	2.5	Refer to Table 2	Refer to Table 2	0.990	2.5
2,2',5-TrCB (18)	37680-65-2	NS	2.5	Refer to Table 2	Refer to Table 2	1.13	2.5
2,2',6-TrCB (19)	38444-73-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.03	2.5
2,3,3'-TrCB (20)	38444-84-7	NS	7.5	Refer to Table 2	Refer to Table 2	2.38[8]	7.5
2,3,4-TrCB (21)	55702-46-0	NS	7.5	Refer to Table 2	Refer to Table 2	2.38[8]	7.5
2,3,4'-TrCB (22)	38444-85-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.933	2.5
2,3,5-TrCB (23)	55720-44-0	NS	2.5	Refer to Table 2	Refer to Table 2	1.21	2.5
2,3,6-TrCB (24)	55702-45-9	NS	5.0	Refer to Table 2	Refer to Table 2	0.822[9]	5.0

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,3',4-TrCB (25)	55712-37-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.82	2.5
2,3',5-TrCB (26)	38444-81-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.51	2.5
2,3',6-TrCB (27)	38444-76-7	NS	5.0	Refer to Table 2	Refer to Table 2	0.822[9]	5.0
2,4,4'-TrCB (28)	7012-37-5	NS	2.5	Refer to Table 2	Refer to Table 2	2.42	2.5
2,4,5-TrCB (29)	15862-07-4	NS	2.5	Refer to Table 2	Refer to Table 2	0.984	2.5
2,4,6-TrCB (30)	35693-92-6	NS	2.5	Refer to Table 2	Refer to Table 2	0.681	2.5
2,4',5-TrCB (31)	16606-02-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.54	2.5
2,4',6-TrCB (32)	38444-77-8	NS	5.0	Refer to Table 2	Refer to Table 2	1.30[7]	5.0
2',3,4-TrCB (33)	38444-86-9	NS	7.5	Refer to Table 2	Refer to Table 2	2.38[8]	7.5
2',3,5-TrCB (34)	37680-68-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.26	2.5
3,3',4-TrCB (35)	37680-69-6	NS	2.5	Refer to Table 2	Refer to Table 2	1.29	2.5
3,3',5-TrCB (36)	38444-87-0	NS	2.5	Refer to Table 2	Refer to Table 2	0.910	2.5
3,4,4'-TrCB (37)	38444-90-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.63	2.5
3,4,5-TrCB (38)	53555-66-1	NS	2.5	Refer to Table 2	Refer to Table 2	0.768	2.5
3,4',5-TrCB (39)	38444-88-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.19	2.5
2,2',3,3'-TeCB (40)	38444-93-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.28	2.5
2,2',3,4-TeCB (41)	52663-59-9	NS	10.0	Refer to Table 2	Refer to Table 2	3.90[10]	10.0
2,2',3,4'-TeCB (42)	36559-22-5	NS	5.0	Refer to Table 2	Refer to Table 2	1.97[11]	5.0
2,2',3,5-TeCB (43)	70362-46-8	NS	5.0	Refer to Table 2	Refer to Table 2	2.03[12]	5.0
2,2',3,5'-TeCB (44)	41464-39-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.08	2.5
2,2',3,6-TeCB (45)	70362-45-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.13	2.5
2,2',3,6'-TeCB (46)	41464-47-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.468	2.5
2,2',4,4'-TeCB (47)	2437-79-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.57	2.5
2,2',4,5-TeCB (48)	70362-47-9	NS	5.0	Refer to Table 2	Refer to Table 2	1.55[13]	5.0
2,2',4,5'-TeCB (49)	41464-40-8	NS	5.0	Refer to Table 2	Refer to Table 2	2.03[12]	5.0
2,2',4,6-TeCB (50)	62796-65-0	NS	2.5	Refer to Table 2	Refer to Table 2	0.825	2.5

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',4,6'-TeCB (51)	68194-04-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.47	2.5
2,2',5,5'-TeCB (52)	35693-99-3	NS	5.0	Refer to Table 2	Refer to Table 2	2.03[14]	5.0
2,2',5,6'-TeCB (53)	41464-41-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.11	2.5
2,2',6,6'-TeCB (54)	15968-05-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.613	2.5
2,3,3',4'-TeCB (55)	74338-24-2	NS	2.5	Refer to Table 2	Refer to Table 2	1.08	2.5
2,3,3',4'-TeCB (56)	41464-43-1	NS	5.0	Refer to Table 2	Refer to Table 2	1.85[15]	5.0
2,3,3',5-TeCB (57)	70424-67-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.13	2.5
2,3,3',5-TeCB (58)	41464-49-7	NS	2.5	Refer to Table 2	Refer to Table 2	2.04	2.5
2,3,3',6-TeCB (59)	74472-33-6	NS	5.0	Refer to Table 2	Refer to Table 2	1.97[11]	5.0
2,3,4,4'-TeCB (60)	33025-41-1	NS	5.0	Refer to Table 2	Refer to Table 2	1.85[15]	5.0
2,3,4,5-TeCB (61)	33284-53-6	NS	5.0	Refer to Table 2	Refer to Table 2	2.96[16]	5.0
2,3,4,6-TeCB (62)	54230-22-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.944	2.5
2,3,4',5-TeCB (63)	74472-34-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.12	2.5
2,3,4',6-TeCB (64)	52663-58-8	NS	10.0	Refer to Table 2	Refer to Table 2	3.90[10]	10.0
2,3,5,6-TeCB (65)	33284-54-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.840	2.5
2,3',4,4'-TeCB (66)	32598-10-0	NS	5.0	Refer to Table 2	Refer to Table 2	2.88[17]	5.0
2,3',4,5-TeCB (67)	73575-53-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.19	2.5
2,3',4,5'-TeCB (68)	73575-52-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.32	2.5
2,3',4,6-TeCB (69)	60233-24-1	NS	5.0	Refer to Table 2	Refer to Table 2	2.03[14]	5.0
2,3'4'5-TeCB (70)	32598-11-1	NS	2.5	Refer to Table 2	Refer to Table 2	2.96[16]	2.5
2,3',4',6-TeCB (71)	41464-46-4	NS	10.0	Refer to Table 2	Refer to Table 2	3.90[10]	10.0
2,3',5,5'-TeCB (72)	41464-42-0	NS	10.0	Refer to Table 2	Refer to Table 2	3.90[10]	10.0
2,3',5',6-TeCB (73)	74338-23-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.28	2.5
2,4,4',5-TeCB (74)	32690-93-0	NS	2.5	Refer to Table 2	Refer to Table 2	0.864	2.5
2,4,4',6-TeCB (75)	32598-12-2	NS	5.0	Refer to Table 2	Refer to Table 2	1.55[13]	5.0
2',3,4,5-TeCB (76)	70362-48-0	NS	5.0	Refer to Table 2	Refer to Table 2	2.88[17]	5.0

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
3,3',4,4'-TeCB (77)	32598-13-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.95	2.5
3,3',4,5-TeCB (78)	70362-49-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.51	2.5
3,3',4,5'-TeCB (79)	41464-48-6	NS	2.5	Refer to Table 2	Refer to Table 2	1.35	2.5
3,3',5,5'-TeCB (80)	33284-52-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.05	2.5
3,4,4',5-TeCB (81)	70362-50-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.63	2.5
2,2',3,3',4-PeCB (82)	52663-62-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.64	2.5
2,2',3,3',5-PeCB (83)	60145-20-2	NS	2.5	Refer to Table 2	Refer to Table 2	0.737	2.5
2,2',3,3',6-PeCB (84)	52663-60-2	NS	5.0	Refer to Table 2	Refer to Table 2	0.837[18]	5.0
2,2',3,4,4'-PeCB (85)	65510-45-4	NS	5.0	Refer to Table 2	Refer to Table 2	0.783[19]	5.0
2,2'3,4,5-PeCB (86)	55312-69-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.80	2.5
2,2',3,4,5'-PeCB (87)	38380-02-8	NS	7.5	Refer to Table 2	Refer to Table 2	1.30[20]	7.5
2,2',3,4,6-PeCB (88)	55215-17-3	NS	5.0	Refer to Table 2	Refer to Table 2	3.56[21]	5.0
2,2',3,4,6'-PeCB (89)	73575-57-2	NS	2.5	Refer to Table 2	Refer to Table 2	0.676	2.5
2,2',3,4',5-PeCB (90)	68194-07-0	NS	5.0	Refer to Table 2	Refer to Table 2	1.93[22]	5.0
2,2',3,4',6-PeCB (91)	68194-05-8	NS	5.0	Refer to Table 2	Refer to Table 2	3.56[21]	5.0
2,2',3,5,5'-PeCB (92)	52663-61-3	NS	10.0	Refer to Table 2	Refer to Table 2	0.837[18]	10.0
2,2',3,5,6-PeCB (93)	73575-56-1	NS	2.5	Refer to Table 2	Refer to Table 2	2.37	2.5
2,2',3,5,6'-PeCB (94)	73575-55-0	NS	2.5	Refer to Table 2	Refer to Table 2	1.07	2.5
2,2',3,5',6-PeCB (95)	38379-99-6	NS	7.5	Refer to Table 2	Refer to Table 2	1.74[23]	7.5
2,2',3,6,6'-PeCB (96)	73575-54-9	NS	2.5	Refer to Table 2	Refer to Table 2	0.747	2.5
2,2',3,4,5-PeCB (97)	41464-51-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.05	2.5
2,2',3',4,6-PeCB (98)	60233-25-2	NS	7.5	Refer to Table 2	Refer to Table 2	1.74[23]	7.5
2,2',4,4',5-PeCB (99)	38380-01-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.46	2.5
2,2',4,4',6-PeCB (100)	39485-83-1	NS	2.5	Refer to Table 2	Refer to Table 2	0.896	2.5
2,2',4,5'5'-PeCB (101)	37680-73-2	NS	5.0	Refer to Table 2	Refer to Table 2	1.93[22]	5.0
2,2',4,5,6'-PeCB (102)	68194-06-9	NS	7.5	Refer to Table 2	Refer to Table 2	1.74[23]	7.5

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',4,5',6-PeCB (103)	60145-21-3	NS	2.5	Refer to Table 2	Refer to Table 2	0.670	2.5
2,2',4,6,6'-PeCB (104)	56558-16-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.397	2.5
2,3,3',4,4'-PeCB (105)	32598-14-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.39	2.5
2,3,3',4,5-PeCB (106)	70424-69-0	NS	5.0	Refer to Table 2	Refer to Table 2	3.32[24]	5.0
2,3,3',4',5-PeCB (107)	70424-68-9	NS	5.0	Refer to Table 2	Refer to Table 2	1.36[25]	5.0
2,3,3',4,5'-PeCB (108)	70362-41-3	NS	5.0	Refer to Table 2	Refer to Table 2	1.99[26]	5.0
2,3,3',4,6-PeCB (109)	74472-35-8	NS	5.0	Refer to Table 2	Refer to Table 2	1.36[25]	5.0
2,3,3'4',6-PeCB (110)	38380-03-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.66	2.5
2,3,3',5,5'-PeCB (111)	39635-32-0	NS	5.0	Refer to Table 2	Refer to Table 2	1.60[27]	5.0
2,3,3',5,6-PeCB (112)	74472-36-9	NS	5.0	Refer to Table 2	Refer to Table 2	1.99[26]	5.0
2,3,3',5',6-PeCB (113)	68194-10-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.16	2.5
2,3,4,4',5-PeCB (114)	74472-37-0	NS	2.5	Refer to Table 2	Refer to Table 2	1.06	2.5
2,3,4,4',6-PeCB (115)	74472-38-1	NS	5.0	Refer to Table 2	Refer to Table 2	1.60[27]	5.0
2,3,4,5,6-PeCB (116)	18259-05-7	NS	5.0	Refer to Table 2	Refer to Table 2	0.783[19]	5.0
2,3,4',5,6-PeCB (117)	68194-11-6	NS	7.5	Refer to Table 2	Refer to Table 2	1.30[20]	7.5
2,3',4,4',5-PeCB (118)	31508-00-6	NS	5.0	Refer to Table 2	Refer to Table 2	3.32[24]	5.0
2,3',4,4',6-PeCB (119)	56558-17-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.96	2.5
2,3',4,5,5'-PeCB (120)	68194-12-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.953	2.5
2,3',4,5',6-PeCB (121)	56558-18-0	NS	2.5	Refer to Table 2	Refer to Table 2	1.49	2.5
2',3,3',4',5'-PeCB(122)	76842-07-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.25	2.5
2,3',4,4',5'-PeCB (123)	65510-44-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.45	2.5
2,3',4',5,5'-PeCB (124)	70424-70-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.33	2.5
2,3',4'5',6-PeCB (125)	74472-39-2	NS	7.5	Refer to Table 2	Refer to Table 2	1.30[20]	7.5
3,3',4,4',5-PeCB (126)	57465-28-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.783	2.5
3,3',4,5,5'-PeCB (127)	39635-33-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.15	2.5
2,2',3,3',4,4'-HxCB (128)	38380-07-3	NS	5.0	Refer to Table 2	Refer to Table 2	1.52[28]	5.0

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',3,3',4,5-HxCB (129)	55215-18-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.33	2.5
2,2',3,3',4,5'-HxCB (130)	52663-66-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.55	2.5
2,2',3,3',4,6-HxCB (131)	61798-70-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.780	2.5
2,2',3,3',4,6'-HxCB (132)	38380-05-1	NS	5.0	Refer to Table 2	Refer to Table 2	1.42[29]	5.0
2,2',3,3',5,5'-HxCB (133)	35694-04-3	NS	5.0	Refer to Table 2	Refer to Table 2	1.99[30]	5.0
2,2',3,3',5,6-HxCB (134)	52704-70-8	NS	5.0	Refer to Table 2	Refer to Table 2	1.54[31]	5.0
2,2',3,3',5,6'-HxCB (135)	52744-13-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.842	2.5
2,2',3,3',6,6'-HxCB (136)	38411-22-2	NS	2.5	Refer to Table 2	Refer to Table 2	0.995	2.5
2,2',3,4,4',5-HxCB (137)	35694-06-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.76	2.5
2,2',3,4,4',5'-HxCB (138)	35065-28-2	NS	7.5	Refer to Table 2	Refer to Table 2	1.24[32]	7.5
2,2',3,4,4',6-HxCB (139)	56030-56-9	NS	5.0	Refer to Table 2	Refer to Table 2	1.81[33]	5.0
2,2',3,4,4',6'-HxCB (140)	59291-64-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.15	2.5
2,2',3,4,5,5'-HxCB (141)	52712-04-6	NS	2.5	Refer to Table 2	Refer to Table 2	1.15	2.5
2,2',3,4,5,6-HxCB (142)	41411-61-4	NS	5.0	Refer to Table 2	Refer to Table 2	1.99[30]	5.0
2,2',3,4,5,6'-HxCB (143)	68194-15-0	NS	5.0	Refer to Table 2	Refer to Table 2	1.54[31]	5.0
2,2',3,4,5',6-HxCB (144)	68194-14-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.29	2.5
2,2',3,4,6,6'-HxCB (145)	74472-40-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.555	2.5
2,2',3,4',5,5'-HxCB (146)	51908-16-8	NS	5.0	Refer to Table 2	Refer to Table 2	2.02[34]	5.0
2,2',3,4',5,6-HxCB (147)	68194-13-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.04	2.5
2,2',3,4',5,6'-HxCB (148)	74472-41-6	NS	2.5	Refer to Table 2	Refer to Table 2	1.53	2.5
2,2',3,4',5',6-HxCB (149)	38380-04-0	NS	5.0	Refer to Table 2	Refer to Table 2	1.81[33]	5.0
2,2',3,4',6,6'-HxCB (150)	68194-08-1	NS	2.5	Refer to Table 2	Refer to Table 2	0.934	2.5
2,2',3,5,5',6-HxCB (151)	52663-63-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.959	2.5
2,2',3,5,6,6'-HxCB (152)	68194-09-2	NS	2.5	Refer to Table 2	Refer to Table 2	0.994	2.5
2,2',4,4',5,5'-HxCB (153)	35065-27-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.11	2.5
2,2',4,4',5',6-HxCB (154)	60145-22-4	NS	2.5	Refer to Table 2	Refer to Table 2	0.785	2.5

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',4,4',6,6'-HxCB (155)	33979-03-2	NS	2.5	Refer to Table 2	Refer to Table 2	1.02	2.5
2,3,3',4,4',5-HxCB (156)	38380-08-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.31	2.5
2,3,3',4,4',5'-HxCB (157)	69782-90-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.670	2.5
2,3,3',4,4',6-HxCB (158)	74472-42-7	NS	5.0	Refer to Table 2	Refer to Table 2	0.962[35]	5.0
2,3,3',4,5,5'-HxCB (159)	39635-35-3	NS	2.5	Refer to Table 2	Refer to Table 2	0.857	2.5
2,3,3',4,5,6-HxCB (160)	41411-62-5	NS	5.0	Refer to Table 2	Refer to Table 2	0.962[35]	5.0
2,3,3',4,5',6-HxCB (161)	74472-43-8	NS	5.0	Refer to Table 2	Refer to Table 2	1.42[29]	5.0
2,3,3',4',5,5'-HxCB (162)	39635-34-2	NS	5.0	Refer to Table 2	Refer to Table 2	1.52[28]	5.0
2,3,3',4',5,6-HxCB (163)	74472-44-9	NS	7.5	Refer to Table 2	Refer to Table 2	1.24[32]	7.5
2,3,3',4',5',6-HxCB (164)	74472-45-0	NS	7.5	Refer to Table 2	Refer to Table 2	1.24[32]	7.5
2,3,3',5,5',6-HxCB (165)	74472-46-1	NS	5.0	Refer to Table 2	Refer to Table 2	2.02[34]	5.0
2,3,4,4',5,6-HxCB (166)	41411-63-6	NS	2.5	Refer to Table 2	Refer to Table 2	0.737	2.5
2,3',4,4',5,5'-HxCB (167)	52663-72-6	NS	2.5	Refer to Table 2	Refer to Table 2	1.17	2.5
2,3',4,4',5',6-HxCB (168)	59291-65-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.813	2.5
3,3',4,4',5,5'-HxCB (169)	32774-16-6	NS	2.5	Refer to Table 2	Refer to Table 2	0.743	2.5
2,2',3,3',4,4',5-HpCB (170)	35065-30-6	NS	2.5	Refer to Table 2	Refer to Table 2	0.566	2.5
2,2',3,3',4,4',6-HpCB (171)	52663-71-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.876	2.5
2,2',3,3',4,5,5'-HpCB (172)	52663-74-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.513	2.5
2,2',3,3',4,5,6-HpCB (173)	68194-16-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.27	2.5
2,2',3,3',4,5,6'-HpCB (174)	38411-25-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.14	2.5
2,2',3,3',4,5',6-HpCB (175)	40186-70-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.19	2.5
2,2',3,3',4,6,6'-HpCB (176)	52663-65-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.06	2.5
2,2',3,3',4',5,6-HpCB (177)	52663-70-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.41	2.5
2,2',3,3',5,5',6-HpCB (178)	52663-67-9	NS	2.5	Refer to Table 2	Refer to Table 2	0.600	2.5
2,2',3,3',5,6,6'-HpCB (179)	52663-64-6	NS	2.5	Refer to Table 2	Refer to Table 2	0.627	2.5
2,2',3,4,4',5,5'-HpCB (180)	35065-29-3	NS	2.5	Refer to Table 2	Refer to Table 2	0.956	2.5

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',3,4,4',5,6-HpCB (181)	74472-47-2	NS	2.5	Refer to Table 2	Refer to Table 2	1.28	2.5
2,2',3,4,4',5,6'-HpCB (182)	60145-23-5	NS	5.0	Refer to Table 2	Refer to Table 2	0.796[36]	5.0
2,2',3,4,4',5',6-HpCB (183)	52663-69-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.11	2.5
2,2',3,4,4',6,6'-HpCB (184)	74472-48-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.02	2.5
2,2',3,4,5,5',6-HpCB (185)	52712-05-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.896	2.5
2,2',3,4,5,5',6-HpCB (186)	74472-49-4	NS	2.5	Refer to Table 2	Refer to Table 2	0.908	2.5
2,2',3,4,5,5',6-HpCB (187)	52663-68-0	NS	5.0	Refer to Table 2	Refer to Table 2	0.796[36]	5.0
2,2',3,4,5,5',6-HpCB (188)	74487-85-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.593	2.5
2,3,3',4,4',5,5'-HpCB (189)	39635-31-9	NS	2.5	Refer to Table 2	Refer to Table 2	0.825	2.5
2,3,3',4,4',5,6-HpCB (190)	41411-64-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.680	2.5
2,3,3',4,4',5',6-HpCB (191)	74472-50-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.873	2.5
2,3,3',4,5,5',6-HpCB (192)	74472-51-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.417	2.5
2,3,3',4',5,5',6-HpCB (193)	69782-91-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.607	2.5
2,2',3,3',4,4',5,5'-OcCB (194)	35694-08-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.432	2.5
2,2',3,3',4,4',5,6-OcCB (195)	52663-78-2	NS	2.5	Refer to Table 2	Refer to Table 2	1.18	2.5
2,2',3,3',4,4',5,6'-OcCB (196)	42740-50-1	NS	5.0	Refer to Table 2	Refer to Table 2	2.50[37]	5.0
2,2',3,3',4,4',6,6'-OcCB (197)	33091-17-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.864	2.5
2,2',3,3',4,5,5',6-OcCB (198)	68194-17-2	NS	2.5	Refer to Table 2	Refer to Table 2	0.809	2.5
2,2',3,3',4,5,5',6'-OcCB (199)	52663-75-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.99	2.5
2,2',3,3',4,5,6,6'-OcCB (200)	52663-73-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.13	2.5
2,2',3,3',4,5',6,6'-OcCB (201)	40186-71-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.627	2.5
2,2',3,3',5,5',6,6'-OcCB (202)	2136-99-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.01	2.5
2,2',3,4,4',5,5',6-OcCB (203)	52663-76-0	NS	5.0	Refer to Table 2	Refer to Table 2	2.50[37]	5.0
2,2',3,4,4',5,6,6'-OcCB (204)	74472-52-9	NS	2.5	Refer to Table 2	Refer to Table 2	0.872	2.5
2,3,3',4,4',5,5',6-OcCB (205)	74472-53-0	NS	2.5	Refer to Table 2	Refer to Table 2	0.854	2.5

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',3,3',4,4',5,5',6-NoCB (206)	40186-72-9	NS	2.5	Refer to Table 2	Refer to Table 2	0.733	2.5
2,2',3,3',4,4',5, 6,6'-NoCB (207)	52663-79-3	NS	2.5	Refer to Table 2	Refer to Table 2	0.370	2.5
2,2',3,3',4,5,5',6,6'-NoCB (208)	52663-77-1	NS	2.5	Refer to Table 2	Refer to Table 2	0.640	2.5
DeCB (209)	2051-24-3	NS	2.65	Refer to Table 2	Refer to Table 2	0.941	2.5

ng/kg = nanograms per kilogram
NS = Not Specified
NA = Not available or not applicable
*Refers to Table 2 in EPA Method 1668C.
[1]Based on LOD/LOQ Study from Vista Analytical dated 8/26/2013
[2]Final QL will be adjusted based on the total solids content for each sample.
[3] MDL represents PCB 4/10, [4] MDL represents PCB 5/8, [5] MDL represents PCB 7/9, [6] MDL represents PCB 12/13, [7] MDL represents PCB 16/32, [8] MDL represents PCB 20/21/33, [9] MDL represents PCB 24/27, [10] MDL represents PCB 41/64/71/72, [11] MDL represents PCB 42/59, [12] MDL represents PCB 43/49, [13] MDL represents PCB 48/75, [14] MDL represents PCB 52/69, [15] MDL represents PCB 56/60, [16] MDL represents PCB 61/70, [17] MDL represents PCB 76/66, [18] MDL represents PCB 84/92, [19] MDL represents PCB 85/116, [20] MDL represents PCB 87/117/125, [21] MDL represents PCB 88/91, [22] MDL represents PCB 90/101, [23] MDL represents PCB 95/98/102, [24] MDL represents PCB 106/118, [25] MDL represents PCB 107/109, [26] MDL represents PCB 108/112, [27] MDL represents PCB 111/115, [28] MDL represents PCB 128/162, [29] MDL represents PCB 132/161, [30] MDL represents PCB 133/142, [31] MDL represents PCB 134/143, [32] MDL represents PCB 138/163/164, [33] MDL represents PCB 139/149, [34] MDL represents PCB 146/165, [35] MDL represents PCB 158/160, [36]MDL represents PCB 182/187, [37] MDL represents PCB 196/203.

QAPP Worksheet #15-3
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: HCX

Concentration Level: Low

Analyte	CAS Number	Project Action Limit * (µg/kg)	Project Quantitation Limit (µg/kg)	Analytical Method Vista SOP #41		Achievable Laboratory Limits	
				MDLs (µg/kg)	Method QLs(µg/kg)	MDLs[1] (µg/kg)	QLs (µg/kg)
124578-Hexachloroxanthene	38178-99-3	NS	0.02	NS	0.02	0.00466	0.02

*Based on LOD study from Vista dated 6/15/2011 - New MDL to be determined one new source of HCP is received by the laboratory
NS = Not Specified
µg/kg = micrograms per kilogram

QAPP Worksheet #15-4
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: HCP

Concentration Level: Low

Analyte	CAS Number	Project Action Limit * (µg/kg)	Project Quantitation Limit (µg/kg)	Analytical Method Vista SOP #50		Achievable Laboratory Limits	
				MDLs (µg/kg)	Method QLs(µg/kg)	MDLs[1] (µg/kg)	QLs (µg/kg)
Hexachlorophene	70-30-4	NS	0.50	NS	0.50	0.130	0.50

*Based on LOD study from Vista dated 6/15/2011 – New MDL to be determined one new source of HCP is received by the laboratory
NS = Not Specified
µg/kg = micrograms per kilogram

QAPP Worksheet #15-5
Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: TCDT

Concentration Level: Low

Analyte	CAS Number	Project Action Limit * (µg/kg)	Project Quantitation Limit (µg/kg)	Analytical Method EPA Method 1613B Modified		Achievable Laboratory Limits	
				MDLs (µg/kg)	Method QLs(µg/kg)	MDLs[1] (µg/kg)	QLs (µg/kg)
2468-Tetrachlorodibenzothiophene	134705-49-0	NS	TBD	NS	NS	TBD	TBD

NS = Not Specified
µg/kg = micrograms per kilogram
TBD = To be determined upon receipt of TCDT standard and prior to sample analysis

QAPP Worksheet #15-6
Reference Limits and Evaluation Table

Matrix:	Sediment
Analytical Group:	Radionuclides
Concentration Level:	Low

Analyte	CAS Number	Project Action Limit (pCi/g)	Project Quantitation Limit (pCi/g)	Analytical Method		Achievable Laboratory Limits[3]
				MDLs	Method QLs (pCi/g)	QLs (pCi/g)
Beryllium-7	13966-02-4	NA[1]	0.3	NA	NA	0.3
Cesium-137	10045-97-3	NA[1]	0.10	NA	NA	0.10

NS = not specified
NA = not applicable
1. There are no action levels established for these parameters for this Study.
2. The target QLs are set at a low level intended to allow for dating of the sediment.
3. Lab results will be in dry weight. Actual QLs may be higher and are dependent on the amount of sample available and counting time.

pCi/g = picocuries per gram

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #16
Project Schedule Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Field Sampling Activities	SERAS	11/18/13	11/20/13	Trip Report	14 days following return from the field investigation
Dioxin/Furan, PCB Congeners and total PCBs, HCX, HCP and TCDT Analyses	Vista Analytical	11/20/13	TBD (Timeline for the TCDT analyses are unknown at this time)	Analytical Data Package	6 weeks after receipt of samples
Cs-137 and Be-7 Analyses	Outreach Lab	11/20/13	01/08/14	Analytical Data Package	35 business days after receipt
Trip Report Preparation	SERAS	11/20/13	12/08/13	Trip Report	14 days following return from the field investigation
Validation of Dioxin/Furan, PCB Congeners and total PCBs, HCX, HCP and TCDT	SERAS	Upon receipt of data package	Within 4 weeks	Analytical Report	Within 4 weeks after receipt of last data package
Validation of Cs-137 and Be-7	SERAS	Upon receipt of data package	Within 4 weeks	Analytical Report	Within 4 weeks after receipt of last data package
Summary Report Preparation	SERAS	Upon receipt of validated data	Within 2 weeks	Draft Summary Report	Within 2 weeks after receipt of validated data

QAPP Worksheet #17
Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):
The overall objective of this study is to evaluate if potential sources of contamination found in the sediment deposits at RM 10.9 of the Passaic River may be potentially linked to the former Givaudan or Diamond Alkali facilities. Resource limitations (costly analytical method development and analysis) have led to the development of a focused study design and sample size of 30 for analysis of the contaminants of concern across all targeted locations. These locations include the sediments at Passaic River RM 10.9 and the Third River, and the waste cells present on the former Givaudan and Diamond Alkali facilities. This sampling and analysis plan pertains to the sampling of sediments.

Sediment sampling will be conducted at the following locations:

- "No-dredge zone" portion of the Removal Area,
- Downstream of the designated Removal Area,
- In the region of the confluence of the Third River with the Passaic River
- In the Third River above the Rte. 21 bridge
- Upstream of the Third and Passaic Rivers confluence near Dundee Dam

These sampling results will be compared to samples which will be collected from the former Givaudan and Diamond Alkali facilities waste cells (note: sampling at the former facilities will be provided in a revision to this document).

The weight of evidence approach which will be used to evaluate the former Givaudan and Diamond Alkali facilities as potential sources of sediment contamination within this stretch of the Passaic will include the computation of contaminant ratios which will act as a method of fingerprinting the waste streams produced by the historical chemical processes of Givaudan and Diamond Alkali. These fingerprints will be compared to the contaminant ratios found within the no dredge zone, below the Removal Area, within the Third River and its confluence with the Passaic River and upstream near the Dundee Dam. The evaluation of chromatographic results (e.g., peak patterns, chemical signatures, etc.) will also be used as a line of evidence.

No-Dredge Zone. Sampling within the Removal Area will occur within the no-dredge zone of the RM 10.9 Removal Area. Dredging activities in the Removal Area were completed on October 4, 2013 and capping is expected to commence during the week of November 4, 2013. The no-dredge zone overlays a known underground water pipe. Historical data from within the no dredge zone is limited to 4 sediment core locations from which samples were collected in 2011. TCDD concentrations were highest at the surface of the sediments, decreasing with depth, and with a significant drop-off below 3.5 feet. PCBs at these 4 locations were also consistently within detectable ranges at surface and down to 2.5 feet. These results indicate that focusing on the top 2 feet of sediments is expected to be useful for the present investigation.

Sediment sampling and analysis for the COCs will be conducted at the surface (0 to 6 inches) for all four proposed sediment locations. Two sediment cores will be sampled from the 1-3' interval and two samples will be sampled from 3-5' interval. Historical data has indicated that both TCDD and PCBs are within detectable ranges at these depth intervals. These samples will be collected from four cores (total of 8 samples) located within the center of the no-dredge zone. Visual Sample Plan was used to generate 4 random coordinates within this area. Randomness was included in the sample design to support future comparisons with the Givaudan and Diamond Alkali waste cell results. Coordinates of the cores are below:

X-Coordinate:	Y-Coordinate:
572930.3495	4518941.0445
572917.6358	4518907.5235
572909.6868	4518916.4624
572928.7603	4518923.1666

A core will also be advanced to approximately 4 feet with samples collected every ½ foot, for a total of 8 samples, which will be sent for Cs-137 and Be-7 dating. The sampling depths of the COCs will be linked to a frame of time when the corresponding sediment was deposited in the river.

Downstream of the Removal Area. Examination of the TCDD and PCB analytical results for historical sampling which occurred in the "fingertip" portion (below the removal area) of the sediment deposit area identified high levels of TCDD at depths between 5 ½ to 7 ½ feet with TCDD concentrations as high as 40,800 picograms per gram (pg/g). These samples were collected in 2011. To further investigate these deposits, the present study will collect 3 cores south of the removal area with sample collection occurring from the interval of 6 to 8 feet. Coordinates of the proposed core locations are:

X-Coordinate:	Y-Coordinate:
572753.6416	4518629.4755
572779.7475	4518757.6318
572764.7168	4518698.3002

A core will also be advanced within this area to approximately 8 feet with samples collected every ½ foot, for a total of 16 samples, which will be sent for Cs-137 and Be-7 dating.

Third River. The Third River will be evaluated as a potential transport pathway of waste from the Givaudan facility; however, there are limited historical data regarding COC concentrations within the sediment in the Third River and at its confluence with the Passaic.

It is recommended that 2 cores be advanced into the sediments at the confluence of the Rivers. At this time, no information is available regarding the depth of the sediment within this area. Suggested sampling intervals are surface (0-6 inches) and 1 foot above the bottom of the sediment (to be determined in the field by probing), which will result in another 4 samples for analysis of COCs. An additional core will be advanced in this area, with samples collected every ½' until the bottom of the sediment is reached. These samples will be sent for Cs-137 and Be-7 dating.

It is recommended that three surface sediment samples be collected within the Third River above the Rte. 21 Bridge. Location of these samples will be dependent on the river flow and the actual presence of sediment. In this region, much of the Third River has a rocky, graveled bottom with little sediment.

Upstream Reference Location. One sediment sample will be collected from a location above Dundee Dam, upstream of the confluence of the Third and Passaic Rivers. It is anticipated that samples will be collected from the 0-0.5' and 1-2' intervals. An additional core will be advanced in this area, with samples collected every ½' to 4'. These samples will be sent for Cs-137 and Be-7 dating.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:
Refer to Worksheets 11, 14 and 18

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
ND-001-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1+1	SERAS SOP #2016	Based on historical data
ND-001-1.0-3.0	Sediment	1-2	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-002-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-002-1.0-3.0	Sediment	1-2	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-003-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-003-3.0-5.0	Sediment	1-2	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-004-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-004-3.0-5.0	Sediment	1-2	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-005-0.0-0.5	Sediment	0-0.5	Cs-137 & Be-7	Low	1+1	SERAS SOP #2016	Will be used to date sediment cores

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
ND-005-0.5-1.0	Sediment	0.5-1.0	Cs-137 & Be-7	Low	1+1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-1.0-1.5	Sediment	1.0-1.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-1.5-2.0	Sediment	1.5-2.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-2.0-2.5	Sediment	2.0-2.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-2.5-3.0	Sediment	2.5-3.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-3.0-3.5	Sediment	3.0-3.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-3.5-4.0	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-4.0-4.5	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-4.5-5.0	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-001-6.0-8.0	Sediment	6.0-8.0	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
BRA-002-6.0-8.0	Sediment	6.0-8.0	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
BRA-003-6.0-8.0	Sediment	6.0-8.0	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
BRA-004-0.0-0.5	Sediment	0.0-0.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-0.5-1.0	Sediment	0.5-1.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-1.0-1.5	Sediment	1.0-1.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-1.5-2.0	Sediment	1.5-2.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-2.0-2.5	Sediment	2.0-2.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-2.5-3.0	Sediment	2.5-3.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-3.0-3.5	Sediment	3.0-3.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-3.5-4.0	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
BRA-004-4.0-4.5	Sediment	4.0-4.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-4.5-5.0	Sediment	4.5-5.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-5.0-5.5	Sediment	5.0-5.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-5.5-6.0	Sediment	5.5-6.0	Cs-137 & Be-7	Low	1+1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-6.0-6.5	Sediment	6.0-6.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-6.5-7.0	Sediment	6.5-7.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-7.0-7.5	Sediment	7.0-7.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-7.5-8.0	Sediment	7.5-8.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-001-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
TRC-001-xx-xx	Sediment	TBD (1 foot above sediment surface	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
TRC-002-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
TRC-002-xx-xx	Sediment	TBD (1 foot above sediment surface	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
TRC-003-0.0-0.5	Sediment	0-0.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-0.5-1.0	Sediment	0.5-1.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-1.0-1.5	Sediment	1.0-1.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-1.5-2.0	Sediment	1.5-2.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-2.0-2.5	Sediment	2.0-2.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-2.5-3.0	Sediment	2.5-3.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-3.0-3.5	Sediment	3.0-3.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-3.5-4.0	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
TRC-003-4.0-4.5	Sediment	4.0-4.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-4.5-5.0	Sediment	4.5-5.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-5.0-5.5	Sediment	5.0-5.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-5.5-6.0	Sediment	5.5-6.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-6.0-6.5	Sediment	6.0-6.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-6.5-7.0	Sediment	6.5-7.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-7.0-7.5	Sediment	7.0-7.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-7.5-8.0	Sediment	7.5-8.0	Cs-137 & Be-7	Low	1+1	SERAS SOP #2016	Will be used to date sediment cores
TR-001-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
TR-002-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
TR-003-0.0.-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
DD-001-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Upstream reference location
DD-001-1.0-2.0	Sediment	1.0-2.0	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-0.0-0.5	Sediment	0-0.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-0.5-1.0	Sediment	0.5-1.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-1.0-1.5	Sediment	1.0-1.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-1.5-2.0	Sediment	1.5-2.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-2.0-2.5	Sediment	2.0-2.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-2.5-3.0	Sediment	2.5-3.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-3.0-3.5	Sediment	3.0-3.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-3.5-4.0	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #21)
** Field replicates have been arbitrarily selected and will be chosen in the field at the frequency of 1:20 samples and based on mass available. Based on the number of samples listed in Worksheet 18, one field replicate will be collected for TCDD/TCDF, PCB congeners and total PCBs, HCX, HCP and TCDT. Three field replicates will be selected for Cs-137 and Be-7 dating.

ND = No Dredge Zone

Location	X-Coordinate:	Y-Coordinate:
001	572930.3495	4518941.0445
002	572917.6358	4518907.5235
003	572909.6868	4518916.4624
004	572928.7603	4518923.1666

BRA = Downstream of Removal Area

Location	X-Coordinate:	Y-Coordinate:
001	572753.6416	4518629.4755
002	572779.7475	4518757.6318
003	572764.7168	4518698.3002

TRC = Third River and Passaic River Confluence
TR = Third River
DD = Dundee Dam
xx-xx = 1 foot above sediment bottom

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference [1]	Sample Volume[2]	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Sediment	17 Dioxins/furans + TCDT	Low	EPA 1613B	10 grams	8-oz jar	≤-10 degrees C, light protected	Up to 1 year
Sediment	209 PCB Congeners + total PCBs	Low	EPA 1668C	10 grams			
Sediment	HCP	Low	Vista SOP #50, Revision 2	10 grams			
Sediment	124578-HCX	Low	Vista SOP #41, Revision 2	10 grams	4-oz amber	≤6 degrees C, light protected	14 days from collection/40 days from extraction
Sediment	Cs-137 & Be-7	Low	Outreach SOP #RAD_04-11	~200 grams	16-oz plastic sealable bag or equivalent	None	None

[1] Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)
NA = Not available or not applicable
C = Centigrade

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #20
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Samples[2]	No. of Field Replicates[2]	No. of MS/MSD	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Sediment	17 Dioxin/Furans, homologs + TCDT	Low	EPA 1613B	19	1	1	NA	NA	NA	20
Sediment	PCBs Congeners Full List 209 Congeners + total PCBs	Low	EPA 1668C	19	1	1	NA	NA	NA	20
Sediment	HCX	Low	Vista SOP #41	19	1	1	NA	NA	NA	20
Sediment	HCP	Low	Vista SOP #50	19	1	1	NA	NA	NA	20
Sediment	Cs-137 & Be-7	Low	Outreach SOP #RAD_04-11	48	3	NA	NA	NA	NA	51

[1] Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #21
Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
SERAS SOP #2001	General Field Sampling Guidelines	SERAS	General Sampling	☐	
SERAS SOP #2003	Sample Storage, Preservation and Handling	SERAS	Sample Handling	☐	
SERAS SOP #2002	Sample Documentation	SERAS	NA	☐	
SERAS SOP #2004	Sample Packaging and Shipment	SERAS	NA	☐	
SERAS SOP #4005	Chain of Custody Procedures	SERAS	NA	☐	
SERAS SOP #2016	Sediment Sampling	SERAS	Vibracore	☐	

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GPS		As per manufacturer's instructions	As per manufacturer's instructions	Check Battery	Daily	Able to pick up signal	Recharge or replace battery	Field personnel	

[1]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #23
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
EPA 1613B	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS	Definitive	Dioxin/furans/ homologs/TCDT	HRGC/HRMS	Vista Analytical	Yes – TCDT added
EPA 1668C	Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/HRMS	Definitive	PCB Congeners – full list + total PCBs	HRGC/HRMS	Vista Analytical	
Vista SOP #41, Revision 2	Extraction and Analysis of Hexachloroxanthene by HRMS	Definitive	HCX	GC/HRMS	Vista Analytical	
Vista SOP #50, Revision 2	Preparation and Analysis of Aqueous and Solid Matrices for the Determination of Hexachlorophene	Definitive	HCP	LC/MS/MS	Vista Analytical	
Outreach SOP #RAD_04-11	Sample Analysis by Gamma Spectrometry	Definitive	Cs-137 & Be-7	High purity germanium detector	Outreach Laboratory	

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #24-1
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
HRGC/HRMS (dioxins/furans and TCDT)	Tune using PFK	Prior to sample analysis	Resolving power ≥10,000 at m/z = 304.9824 or any other reference signal close to m/z 304 (from TCDF). Deviation between the exact m/z and theoretical m/z must be <5ppm	Retune instrument Reanalyze PFK	Vista Analytical Chemist	EPA 1613B (with TCDT added)
	Column Performance Check Solution (CPCM). Solution includes the Window Defining Mix	Prior to 12 hours of sample analysis	Used to set retention times of first and last eluters. CPCM must have ≤25% valley resolution for 2,3,7,8-TCDD and 2,3,7,8-TCDF	Readjust windows. Evaluate system. Perform maintenance. Reanalyze CPCM.		
	6-Point Initial Calibration (ICAL)	Initially and as required	Ion ratios within Table 9 limits*, and S/N ≥10:1. Absolute retention time of $^{13}C_{12}$-1234-TCDD >25 min on DB-5 column and retention time of $^{13}C_{12}$-1234-TCDD > 15 minutes on DB-225 column	Evaluate system. Recalibrate. If all criteria are met except the ion ratios, evaluate impact and document		
	Daily Continuing Calibration Verification (CCAL)	Once per 12 hours, prior to sample analysis	Analyte concentrations must be within the limits specified in Table 6 of method 1613B.	Evaluate system. Evaluate data for usability. Reanalyze CCAL. Recalibrate (ICAL).		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)
*Due to different ions monitored for PeCDD, the ion ratio will differ from the limits in EPA Method Table 9. The M+2 and M+4 are monitored because there is less interference from PCBs.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #24-2
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
HRGC/HRMS (PCB Congeners)	Tune using PFK	Prior to sample analysis	Resolving power ≥10,000 at m/z = 304.9824 or any other significant PFK fragment in the 300-350 range. The deviation between each monitored exact m/z and the theoretical m/z must be <5ppm	Retune instrument Reanalyze PFK	Vista Analytical Chemist	EPA Method 1668C
	6-Point Initial Calibration (ICAL)	Initially and as required	%RSD ±20% Ion ratios within Table 8 limits, and S/N ≥10	Evaluate system. Recalibrate.		
	Daily Continuing Calibration Verification (ICAL)	Once per 12 hours, prior to sample analysis	Compare recovery with calibration verification limit in Table 6. Ion ratios within Table 8 limits and S/N >10	Evaluate system. Reanalyze CCAL. Recalibrate (ICAL) as necessary.		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

QAPP Worksheet #24-3
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/HRMS (HCX)	Initial Calibration (5-point)	Whenever a new set of spiking calibration standards are created or whenever the continuing calibration falls outside the acceptance criteria	Signal to noise (S/N) ratio exceeds 10:1 for all ions monitored Ion abundance ratios are within ±15% of the theoretical ratio %RSD for the mean RFs must be within ±20% for the natives and ±35% for the internal standards	A new initial calibration curve must be prepared	Vista Analytical/ Chemist	Vista SOP #41
	Continuing Calibration	At the beginning of a 12-hour sequence	% Deviation recoveries must be 70-130% for the natives and 50-150% for the labeled compounds	Instrument must be recalibrated and the affected samples reanalyzed		
			Ion ratios must be within criteria listed in Table 1 S/N ratio must exceed 10:1 for all ions monitored	Reanalyze associated sample extracts		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)
[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

QAPP Worksheet #24-4
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
LC/MS/MS (HCP)	Initial Calibration (5-point)	Whenever a new set of spiking calibration standards are created or whenever the continuing calibration falls outside the acceptance criteria	%RSD ±20 for natives and ±30 for internal standards	A new initial calibration curve must be prepared	Vista Analytical/ Chemist	Vista SOP #50
	Continuing Calibration	At the beginning of a 12-hour sequence	% Deviation recoveries must be 70-130% for the native and the labeled compound	Instrument must be recalibrated and the affected samples reanalyzed		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)
[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

QAPP Worksheet #24-5
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
High purity germanium detector	Single Calibration Standard	Daily	Within control chart limits	Recount twice. If still out, conduct instrument maintenance	Outreach Analyst	RAD_04-11
	Instrument Calibration Blank	Daily	Result-error ≤SDL	Recount twice. Recalibrate		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference [1]
HRGC/HRMS	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Vista Analytical Chemist	NA
GC/HRMS	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Vista Analytical Chemist	NA
LC/MS/MS	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Vista Analytical Chemist	NA
High Purity Germanium Detector	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Outreach Lab Chemist	NA

[1]Specify the appropriate reference letter or number from Analytical SOP References table (Worksheet #23)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #26
Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Christopher Gussman/SERAS
Sample Packaging (Personnel/Organization): Christopher Gussman/SERAS
Coordination of Shipment (Personnel/Organization): Christopher Gussman/SERAS
Type of Shipment/Carrier: Fed-Ex to Vista Analytical and Outreach Laboratory
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodian, Vista Analytical and Outreach Laboratory
Sample Custody and Storage (Personnel/Organization): SERAS TL, Christopher Gussman and Sample Custodian, Vista Analytical and Outreach Laboratory
Sample Preparation (Personnel/Organization): Laboratory Chemists, Vista Analytical and Outreach Laboratory
Sample Determinative Analysis (Personnel/Organization): Laboratory Chemists, Vista Analytical and Outreach Laboratory
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Ship within 1 to 3 days to the respective laboratories.
Sample Extract/Digestate Storage (No. of days from extraction/digestion): All samples are to be extracted and analyzed within holding times mandated by each analytical method.
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodian, Vista Analytical and Outreach Laboratory
Number of Days from Analysis: As per subcontract laboratories defined procedures to retain samples once results have been reported.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #27
Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Each sample container will be affixed with a label identifying the sample number, sample location, collection date, collection time, matrix, requested analysis, and preservative. Each sample container will be placed in a re-sealable clear plastic bag and stored in a cooler on wet ice after collection. Sample coolers/containers will be forwarded to the assigned laboratories under specific chain-of-custody (COC) forms, and shipped via overnight courier to laboratory personnel. Sample coolers will contain ample packing material and wet ice, and will be sealed with duct tape or strapping tape. Custody seals will be placed over openings to ensure cooler and sample integrity. At least two custody seals will be placed across the shipping containers to ensure sample integrity. EPA/ERT Scribe software will be used for sample management, as well as, generation of sample documentation, such as, labels and COC records. All COC records will be peer reviewed prior to shipment of samples in accordance with SERAS SOP # 4005, *Chain of Custody Procedures.* Samples will be shipped within 24-72 hours of sampling for next-day delivery under COC to the appropriate laboratory in accordance with SERAS SOP #2004, *Sample Packaging and Shipment.* Procedures outlined in SOP #2002, #2003, and #2004 will be applied (refer to Worksheet #21).
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): A sample custodian at the subcontract laboratories will accept custody of the shipped samples. As applicable, the custodian will record the cooler temperature, and inspect the samples for discrepancies, proper non-chemical preservation and container integrity before forwarding the samples to the appropriate department for analysis. The laboratory manager will be notified of any problems. Samples may be archived at Vista Analytical until it is known whether a TCDT standard can be synthesized by an outside vendor. Disposal will be in accordance with the outside laboratory's disposal protocols.
Sample Identification Procedures: Each sample will be identified with a unique identification number at the time of collection as follows. An abbreviated letter designation consisting of two or three letters as identified on Worksheet #18 (e.g., ND = No Dredge Zone) followed by a three digit numerical sample number at each area (e.g., 001) and the depth will be assigned to each sample collected. For example, the second core collected at surface from the No-Dredge zone would be labeled as ND-002-0-0.5. A unique laboratory number will be assigned to each sample during receipt at the respective laboratories. The number will be listed on the label of every sample container collected at a given location. Procedures outlined in SOP #2002 will be applied (refer to Worksheet #21).
Chain-of-custody Procedures: Chain-of-custody records will be generated for all samples submitted for analysis using Scribe database software. Procedures outlined in SOP #4005 will be applied (refer to Worksheet #21).

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #28-1
QC Samples Table

Matrix	Sediment
Analytical Group	PCDD/PCDFs/ TCDT*
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1613B
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Internal Standards	Every sample, method blank & LCS	Within limits in Table 7 of EPA Method	1. Check chromatography for interferences, flag data. 2. Check S/N. If <10:1, re-extract sample. 3. If S/N >10:1, evaluate data usability. Check instrument and re-analyze extract if problem is found. 4. Re-extract and re-analyze affected samples.	Vista Analytical Chemist	Accuracy/ Bias	$^{13}C_{12}$-2378-TCDD	25-164 ng/mL
						$^{13}C_{12}$-2378-TCDF	24-169 ng/mL
						$^{13}C_{12}$-12378-PeCDD	25-181 ng/mL
						$^{13}C_{12}$-12378-PeCDF	24-185 ng/mL
						$^{13}C_{12}$-23478-PeCDF	21-178 ng/mL
						$^{13}C_{12}$-123478-HxCDD	32-141 ng/mL
						$^{13}C_{12}$-123678- HxCDD	28-130 ng/mL
						$^{13}C_{12}$-123789 HxCDD	32-141 ng/mL
						$^{13}C_{12}$-123478-HxCDF	26-152 ng/mL
						$^{13}C_{12}$-123678-HxCDF	26-123 ng/mL
						$^{13}C_{12}$-123789-HxCDF	29-147 ng/mL
						$^{13}C_{12}$-234678-HxCDF	28-136 ng/mL
						$^{13}C_{12}$-1234678-HpCDD	23-140 ng/mL
						$^{13}C_{12}$-1234678-HpCDF	28-143 ng/mL

QAPP Worksheet #28-1
QC Samples Table

Matrix	Sediment
Analytical Group	PCDD/PCDFs/ TCDT*
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1613B
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
						$^{13}C_{12}$-1234789-HpCDF	26-138 ng/mL
						$^{13}C_{12}$-OCDD	17-157 ng/mL
						$^{13}C_{12}$-OCDF	17-157 ng/mL
						$^{37}Cl_4$-2378-TCDD	35-197 ng/mL
Method Blank	1 per analytical batch not to exceed 20 field samples per matrix.	<RL	1. Reanalyze if carryover is suspected. 2. If any CDD/CDF >RL or one-third of the regulatory compliance level, then the analysis of samples is halted until the blank associated with the sample batch shows no evidence of contamination.	Vista Analytical Chemist	Accuracy/Bias (Contamination)	<RL	

QAPP Worksheet #28-1
QC Samples Table

Matrix	Sediment
Analytical Group	PCDD/PCDFs/ TCDT*
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1613B
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
OPR	1 per analytical batch not to exceed 20 field samples per matrix	Within Table 6 of EPA Method 1613B	1. Review internal standards. 2. Evaluate data for usability 3. If LCS recoveries are > the upper control limits and the sample results are non-detect, no action is required. 4. If samples have hits >RL, re-extract and re-analyze affected samples.	Vista Analytical Chemist	Accuracy/Bias	2378-TCDD	6.7-15.8 ng/mL
						2378-TCDF	7.5-15.8 ng/mL
						12378-PeCDD	35-71 ng/mL
						12378-PeCDF	40-67 ng/mL
						23478-PeCDF	34-80 ng/mL
						123478-HxCDD	35-82 ng/mL
						123678-HxCDD	38-67 ng/mL
						123789-HxCDD	32-81 ng/mL
						123478-HxCDF	36-67 ng/mL
						123678-HxCDF	42-65 ng/mL
						123789-HxCDF	39-65 ng/mL
						234678-HxCDF	35-78 ng/mL
						1234678-HpCDD	35-70 ng/mL
						1234678-HpCDD	41-61 ng/mL
						1234789-HpCDF	39-69 ng/mL

QAPP Worksheet #28-1
QC Samples Table

Matrix	Sediment
Analytical Group	PCDD/PCDFs/ TCDT*
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1613B
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
						OCDD	78-144 ng/mL
						OCDF	63-170 ng/mL
						$^{13}C_{12}$-2378-TCDD	20-175 ng/mL
						$^{13}C_{12}$-2378-TCDF	22-152 ng/mL
						$^{13}C_{12}$-12378-PeCDD	21-227 ng/mL
						$^{13}C_{12}$-12378-PeCDF	21-192 ng/mL
						$^{13}C_{12}$-23478-PeCDF	13-328 ng/mL
						$^{13}C_{12}$-123478-HxCDD	21-193 ng/mL
						$^{13}C_{12}$-123678-HxCDD	25-163 ng/mL
						$^{13}C_{12}$-123789-HxCDD	21-193 ng/mL
						$^{13}C_{12}$-123478-HxCDF	19-202 ng/mL
						$^{13}C_{12}$-123678-HxCDF	21-159 ng/mL
						$^{13}C_{12}$-123789-HxCDF	17-205 ng/mL
						$^{13}C_{12}$-234678-HxCDF	22-176 ng/mL
						$^{13}C_{12}$-1234678-HpCDD	26-166 ng/mL

QAPP Worksheet #28-1
QC Samples Table

Matrix	Sediment
Analytical Group	PCDD/PCDFs/ TCDT*
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1613B
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
						$^{13}C_{12}$-1234678-HpCDF	21-158 ng/mL
						$^{13}C_{12}$-1234789-HpCDF	20-186 ng/mL
						$^{13}C_{12}$-OCDD	26-397 ng/mL
						$^{13}C_{12}$-OCDF	26-397 ng/mL
Matrix Spike	1 per analytical batch not to exceed 20 field samples per matrix	%R = 50-150 (for native compounds only)	1. Review data for usability. 2. Narrate outliers.	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150 (for native compounds only)	
MS/MSD	1 per analytical batch not to exceed 20 field samples per matrix	RPD ±20%	1. Review data for usability. 2. Narrate outliers.	Vista Analytical Chemist	Accuracy/Bias	RPD ±20%	
Field Duplicate	1 per 20 samples	NA	Document in final deliverable	SERAS TL	Precision	RPD ±35%	

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #28-2
QC Samples Table

Matrix	Sediment
Analytical Group	PCB Congeners
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1668C
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Decision Units	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards	Every sample, method blank & LCS	^{13}C-Mono, Di, TriCB + ^{13}C-23'4'5-TetraCB (%R = 5-145) Remaining Tetra, Penta, Hexa, Hepta, Octa, Nona and DecaCBs (%R = 10-145)	1. Check chromatography for interferences, flag data. 2. Check S/N. If <10:1, re-extract sample. 3. If S/N >10:1, evaluate data usability. Check instrument and re-analyze extract if problem is found. 4. Re-extract and re-analyze affected samples.	Vista Analytical Chemist	Accuracy	^{13}C-Mono, Di, TriCB + ^{13}C-23'4'5-TetraCB (%R = 5-145) Remaining Tetra, Penta, Hexa, Hepta , Octa, Nona and DecaCBs (%R = 10-145)

QAPP Worksheet #28-2
QC Samples Table

Matrix	Sediment
Analytical Group	PCB Congeners
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1668C
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Decision Units	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per analytical batch not to exceed 20 field samples per matrix.	<RL	1. Reanalyze if carryover is suspected. 2. If any congener >2x RL or one-third of the regulatory compliance level, then the analysis of samples is halted until the blank associated with the sample batch shows no evidence of contamination.	Vista Analytical Chemist	Accuracy/Bias (Contamination)	<RL

QAPP Worksheet #28-2
QC Samples Table

Matrix	Sediment
Analytical Group	PCB Congeners
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1668C
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Decision Units	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
OPR	1 per analytical batch not to exceed 20 field samples per matrix	%R = 60-135	1. Review internal standards. 2. Evaluate data for usability 3. If LCS recoveries are > the upper control limits and the sample results are non-detect, no action is required. 4. If samples have hits >RL, re-extract and re-analyze affected samples.	Vista Analytical Chemist	Accuracy/Bias	%R = 60-135

QAPP Worksheet #28-2
QC Samples Table

Matrix	Sediment
Analytical Group	PCB Congeners
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1668C
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Decision Units	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike	1 per analytical batch not to exceed 20 field samples per matrix	%R = 50-150%	1. Review data for usability. 2. Narrate outliers.	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150
MS/MSD	1 per analytical batch not to exceed 20 field samples per matrix	RPD ±20%	1. Review data for usability. 2. Narrate outliers.	Vista Analytical Chemist	Precision	RPD ±20%
Field Duplicates	1 per 20 samples	NA	Document in final deliverable	SERAS TL	Precision	RPD ±35%
Cleanup Recovery Standards	Each sample	%R = 10-145%	1. Use additional cleanup procedures. 2. Use smaller mass of sample	Vista Analytical Chemist	Accuracy/Bias	%R = 10-145%

QAPP Worksheet #28-3
QC Samples Table

Matrix	Sediment
Analytical Group	HCX
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Vista SOP #41
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per analytical batch not to exceed 20 field samples per matrix.	<RL or 10x lower than the concentration found in any sample in the analytical batch	Reextract and reanalyze if the associated method blank does not meet criteria	Vista Analytical Chemist	Accuracy/Bias (Contamination)	<RL or 10x lower than the concentration found in any sample in the analytical batch
OPR	1 per analytical batch not to exceed 20 field samples per matrix	%R = 50-150%	If the OPR is outside of these limits, then the sample and OPR will be re-extracted and analyzed.	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150%
^{13}C-123789-HxCDF (Internal Standard)	Each MB, OPR and sample	%R = 25-150	Reanalyze to confirm, reextract and analyze or document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R = 25-150

Matrix	Sediment
Analytical Group	HCX
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Vista SOP #41
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
^{13}C-123789HxCDD (Cleanup Recovery Standard)	Each MB, OPR and sample	%R = 25-150	Reanalyze to confirm, reextract and analyze or document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R = 25-150
MS	1 per 20 samples of the same matrix	%R = 50-150	Document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150
MS/MSD*	One per 20 samples of the same matrix	RPD ±20%	Document in case narrative	Vista Analytical Chemist	Precision	RPD ±20%
Field Duplicate	1 per 20 samples	NA	Document in final deliverable	SERAS TL	Precision	RPD ±35%

QAPP Worksheet #28-4
QC Samples Table

Matrix	Sediment
Analytical Group	HCP
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Vista SOP #50
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per analytical batch not to exceed 20 field samples per matrix.	<RL	Reextract and reanalyze if the associated method blank does not meet criteria	Vista Analytical Chemist	Accuracy/Bias (Contamination)	<RL
OPR	1 per analytical batch not to exceed 20 field samples per matrix	%R = 50-120%	If the OPR is outside of these limits, then the sample and OPR will be re-extracted and analyzed.	Vista Analytical Chemist	Accuracy/Bias	%R = 50-120%
Internal Standard	Each MB, OPR and sample	%R = 5-153	Reanalyze to confirm, reextract and analyze or document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R = 5-153
MS	1 per 20 samples of the same matrix	%R = 50-150	Document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150
MS/MSD	One per 20 samples of the same matrix	RPD ±50%	Document in case narrative	Vista Analytical Chemist	Precision	RPD ±50%

Matrix	Sediment
Analytical Group	HCP
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Vista SOP #50
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	NA	Document in final deliverable	SERAS TL	Precision	RPD ±35%

QAPP Worksheet #28-5
QC Samples Table

Matrix	Sediment
Analytical Group	Radionuclides Be^{7} & Cs^{137}
Concentration Level	Low/Medium (mg/kg)
Sampling SOP(s)	SERAS SOP #2016
Analytical Method/SOP Reference	Outreach SOP #RAD_04-11
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Outreach Technologies
No. of Sample Locations	4

Lab QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Duplicates	5%	<20 RPD	If not within control chart limits, flag and report in case narrative	Gamma Spectroscopy Laboratory Technician	Precision	<20 RPD
Field Duplicates	5%	NA	Flag and report in Final Deliverable	SERAS TL	Precision	RPD ±35%
LCS	5%	%R = 80-120% or acceptance range set by vendor	Reanalyze LCS and all associated samples	Gamma Spectroscopy Laboratory Technician	Accuracy	%R = 80-120% or acceptance range set by vendor

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #29
Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
Chain of custody records Sample labels Custody seals Site Logbook Field Change Form (if necessary)		Instrument run logs Sample extraction logs Preventative maintenance logs Instrument printouts Internal COC records Temperature logs Standard receipt logs Standard prep logs Data Reduction/Data Review records Analytical Results	Data Assessment Forms Data Validation Check Records	Trip Report Tech Memo (Summary Report) QAPP Work Plan (WP) Health & Safety Plan (HASP)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number
Sediment	Dioxins/Furans + TCDT	Low	See Worksheet 18	EPA 1613B	6 weeks (except TCDT) after receipt of samples	Vista Analytical Laboratory 1104 Windfield Way El Dorado Hills, CA 95762 Martha Maier 916-673-1520	NA
	PCB Congeners			EPA 1668C			
	HCX			Vista SOP #41			
	HCP			Vista SOP #50			
	Radiochemistry			RAD_04-11	4 weeks after receipt of samples	Outreach Technologies 311 N. Aspen Avenue Broken Arrow, OK Ron Eidson 918-251-2515	

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #31
Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Laboratory Accreditation Audit	Every 2 years	External	NELAC accrediting agency	NJDEP	QA/QC Officer/Outreach Laboratory	Laboratory Manager/Outreach Laboratory	NELAC Accrediting Authority
Laboratory Accreditation Audit	Every 2 years	External	NELAC/ISO accrediting agency	CADOH A2LA	QA/QC Officer/Vista Analytical	Laboratory Director/Vista Analytical	NELAC/ISO Accrediting Authority

QAPP Worksheet #32
Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Observations/ Deviations from QAPP	Logbook	Chris Gussman, TL, SERAS	Immediately	Field Change Form	Chris Gussman, TL, SERAS	Within 24 hours of change
Peer Review	In the deliverable	Chris Gussman, TL, SERAS	Prior to deliverable due date	Comments directly in the deliverable	Chris Gussman, TL, SERAS	Prior to deliverable due date
Lab Performance Audits	Audit Report	Outreach Laboratory	Within 30 Days	Corrective Action Plan	Regulatory Agency	Within 30 Days
Lab Performance Audits	Audit Report	Vista Analytical	Within 30 Days	Corrective Action Plan	Regulatory Agency	Within 30 Days

QAPP Worksheet #33
QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Technical Report	Monthly	20th of the month following performance period	Task Leader/SERAS	ERT Project Officer and WAM
QA Report	Quarterly	February, May, August, November	QA/QC Officer/SERAS	ERT Quality Coordinator and ERT Project Officer

QAPP Worksheet #34
Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain of Custody Record	Reviewed by Field Sampling Personnel in field, upon receipt of samples by the outside laboratories and Data Validation Group prior to final analytical report preparation	Internal/ External	SERAS TL Outreach Laboratory Vista Analytical SERAS QA/QC Chemist
Laboratory Data Package	Reviewed for measurement performance criteria	Internal/ External	Outreach Laboratory Vista Analytical SERAS QA/QC Chemist
Analytical Report	Reviewed for accuracy	Internal	SERAS QA/QC Chemist SERAS QA/QC Officer SERAS Program Manager
Trip Report	Reviewed for accuracy	Internal	SERAS Peer Review Team
Technical Memorandum (Summary Report)	Reviewed for accuracy	Internal	SERAS Peer Review Team

QAPP Worksheet #35
Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	SOPs	Ensure that the sampling methods/procedures outlined in QAPP were followed, and that any deviations were noted/approved.	SERAS TL ERT WAM
IIb	SOPs	Determine potential impacts from noted/approved deviations, in regard to PQOs.	SERAS QA/QC Chemist
IIa	Chains of custody	Examine COC forms against QAPP and laboratory contract requirements (e.g., analytical methods, sample identification, etc.).	SERAS TL SERAS QA/QC Chemist
IIa	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, and against COC forms (e.g., holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.).	Vista Analytical Lab Personnel Outreach Laboratory Personnel SERAS QA/QC Chemist SERAS TL
IIb	Laboratory data package	Determine potential impacts from noted/approved deviations, in regard to PQOs. Examples include PQLs and QC sample limits (precision/accuracy).	SERAS QA/QC Chemist SERAS QA/QC Officer

QAPP Worksheet #36
Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIb	Sediment	PCDDs/PCDFs + TCDT	Low	SERAS SOP #1019, *Data Validation Procedures for Dioxin/Furan Analysis by HRGC/HRMS*	SERAS QA/QC Group
IIb	Sediment	PCB Congeners	Low	Draft SOP #1024, *Data Validation Procedures for PCB Congener Analysis Using HRGC/HRMS*	SERAS QA/QC Group
IIb	Sediment	Radiochemistry	Low	Draft SOP #1023, *Data Validation Procedures for Radiochemical Data*	SERAS QA/QC Group
IIb	Sediment	HCX	Low	Draft Data Assessment Form for Hexachloroxanthene (HCX) Data Review	SERAS QA/QC Group
IIb	Sediment	HCP	Low	Draft Data Assessment Form for Hexachlorophene (HCP) Data Review	SERAS QA/QC Group

☐ Worksheet Not Applicable (State Reason)

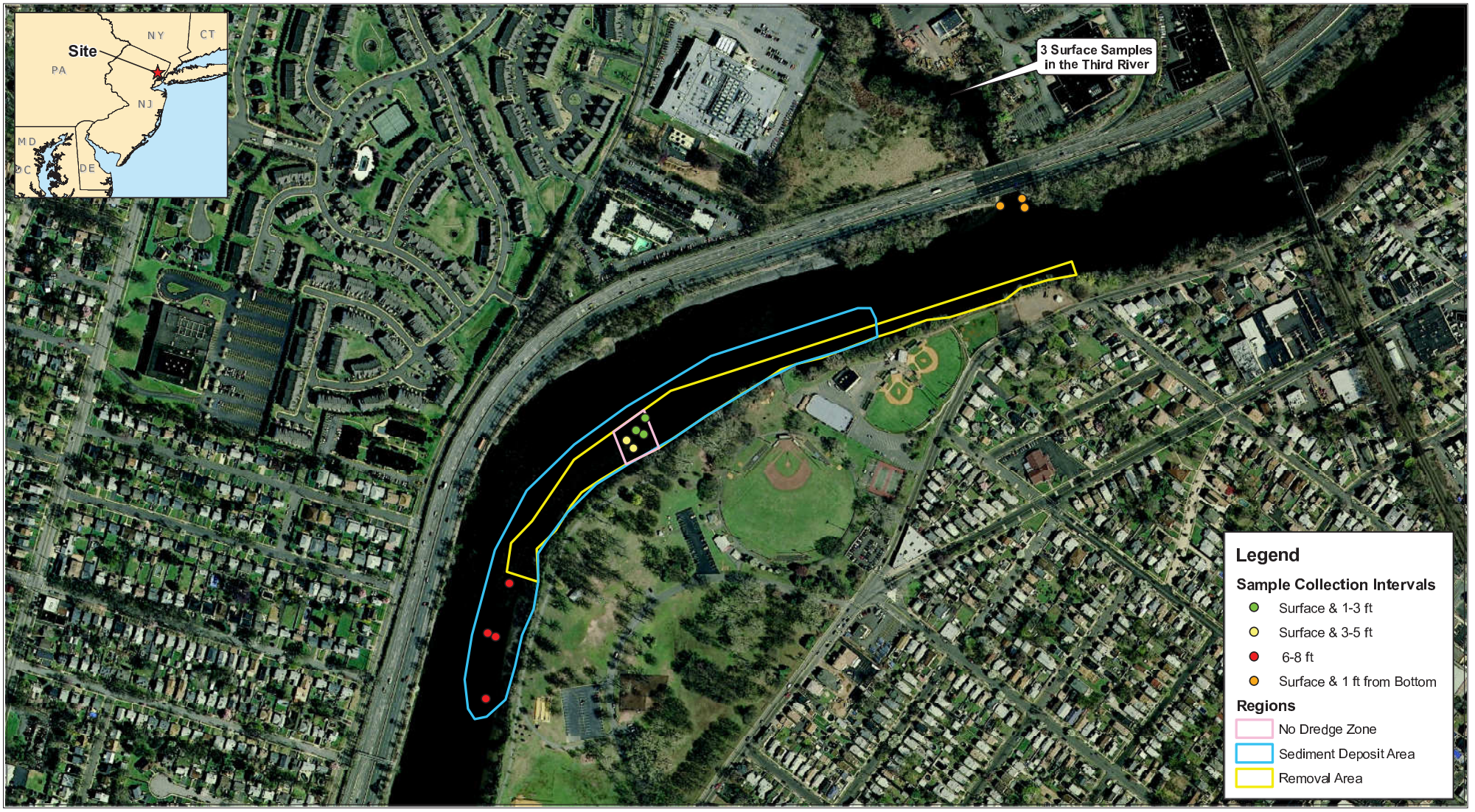
QAPP Worksheet #37
Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: See below.
Describe the evaluative procedures used to assess overall measurement error associated with the project: See below.
Identify the personnel responsible for performing the usability assessment: Assessment of data usability will be done by EPA Region 2 personnel, ERT WAM and SERAS Statistician.
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: Ratios of 2,4,6,8-TCDT to 2,3,7,8-TCDD or other ratios if analytes are expected to be useful for environmental forensics.

The following items will be assessed and conclusions drawn based on their results:

Holding Time: All sample data will be checked to verify that both sample preparation and analysis were performed within the method required holding time.
Calibration: Data associated with instrument calibration and verification of calibration will be reviewed to confirm that all data were generated using properly calibrated instrumentation.
Accuracy/Bias Contamination: Results for all laboratory method blanks and instrument calibration blanks will be checked against performance criteria specified in Worksheet # 28; results for analytes that exceed criteria will be identified and the impact on field sample data will be assessed. Data will be summarized by type of blank.
Accuracy/Bias Overall: Reported values of laboratory control samples, performance samples, and matrix spikes will be evaluated against the spiked or certified concentration and the percent recovery will be calculated and compared to the criteria specified in Worksheet #28. The percent recovery information will be used to assess the bias associated with the analysis. Recovery for matrix spikes in conjunction with the recovery reported for performance samples and laboratory control samples will provide information on the impact of the sample matrix on specific analyses. Average recoveries will be calculated and reported by analyte for each type of QC sample.
Precision: Results of the relative percent difference (RPD) will be calculated for each analyte in laboratory. These RPDs will be checked against measurement performance criteria presented on Worksheet #28; RPDs exceeding the stated criteria will be identified.
Sensitivity: Reporting limits will be checked against the criteria presented on Worksheet #15 and QLs presented on Worksheet #15.
Representativeness: A review of field records will be used to confirm that sample collection and handling was performed in a manner that conformed to the designated SOP. Similarly laboratory preparation procedures will be reviewed during validation to ensure that a representative sample was selected for analysis. Any deviations or modifications to field or laboratory procedures which might impact the representativeness of the sample will be discussed in the project final report.
Comparability: The sampling and analytical procedures which will be used in this program have been selected to ensure that the resulting data will be comparable to data from similar programs conducted previously or which will be conducted in the future. Any modifications or deviations from stated procedures which might impact data comparability will be addressed in the project final report.
Completeness: Completeness for the analytical program will be calculated as the number of data points that are accepted as usable based on the validation process divided by the total number of data points for each analysis.

FIGURE 1
Proposed Sampling Map
Passaic Sediments RM 10.9 Investigation
January 2014



Map Creation Date: October 28, 2013

Coordinate system: NAD_1983_UTM_Zone_18N

Units: Meters

N
W E
S

0 500 1,000 1,500 Feet

D R A F T

Data: g:\arcviewprojects\SERAS01\00-222
MXD file: g:\arcinfoprojects\SERAS01\SER00222_GITVALIDAN\222_Proposed_Sediment_F1_(UTM)

U.S. EPA Environmental Response Team
Scientific Engineering Response and Analytical Services
EP-W-09-031
W.A.# 0-222

Figure 1
Proposed Sediment Sampling Map
Passaic River & Third River
Passaic Sediments
RM 10.9 Investigation
Newark, NJ